



DESCRIPTION

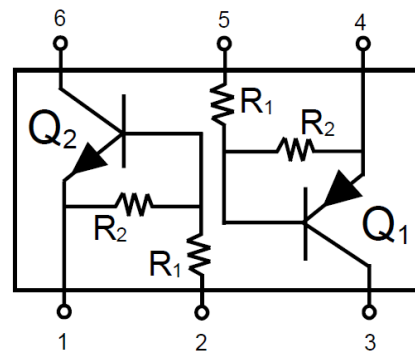
The BRT (Bias Resistor Transistor) contains a single transistor with a monolithic bias network consisting of two resistors; a series base resistor and a base-emitter resistor. These digital transistors are designed to replace a single device and its external resistor bias network. The BRT eliminates these individual components by integrating them into a single device. In the MUN5311DW series, two complementary BRT devices are housed in the SC-88 package which is ideal for low power surface mount applications where board space is at a premium.

The MUN5311DW~ MUN5335DW is available in SC-88 Package

FEATURES

- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in SC-88 Package

PIN DESCRIPTION



ORDERING INFORMATION

Package Type	Part Number
SC-88	MUN5311DW
	MUN5312DW
	MUN5313DW
	MUN5314DW
	MUN5315DW
	MUN5316DW
	MUN5330DW
	MUN5331DW
	MUN5332DW
	MUN5333DW
	MUN5334DW
	MUN5335DW
Note	SPQ: 3,000pcs/Reel
AiT provides all RoHS Compliant Products	



ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$, unless otherwise noted, common for Q_1 and Q_2 , – minus sign for Q_1 (PNP) omitted

V_{CBO} , Collector-Base Voltage	50Vdc
V_{CEO} , Collector-Emitter Voltage	50Vdc
I_C , Collector Current	100mA _{dc}

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

THERMAL CHARACTERISTICS

Parameter (One Junction Heated)	Symbol	Max.	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	187 ^{NOTE1}	mW
		256 ^{NOTE2}	
		1.5 ^{NOTE1}	mW/ $^\circ\text{C}$
		2.0 ^{NOTE2}	
Thermal Resistance-Junction-to-Ambient	$R_{\theta JA}$	670 ^{NOTE1} 490 ^{NOTE2}	$^\circ\text{C}/\text{W}$
Parameter (Both Junctions Heated)	Symbol	Max.	Unit
Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	250 ^{NOTE1}	mW
		385 ^{NOTE2}	
		2.0 ^{NOTE1}	mW/ $^\circ\text{C}$
		3.0 ^{NOTE2}	
Thermal Resistance –Junction-to-Ambient	$R_{\theta JA}$	493 ^{NOTE1} 325 ^{NOTE2}	$^\circ\text{C}/\text{W}$
Thermal Resistance –Junction-to-Lead	$R_{\theta JL}$	188 ^{NOTE1} 208 ^{NOTE2}	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	T_J, T_{STG}	-55 ~ +150	$^\circ\text{C}$

NOTE1: FR-4 @ Minimum Pad

NOTE2: FR-4 @ 1.0 x 1.0 inch Pad



ELECTRICAL CHARACTERISTICS

T_A = 25°C unless otherwise noted, common for Q₁ and Q₂, - minus sign for Q₁ (PNP) omitted

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
ON CHARACTERISTICS^{NOTE3}							
DC Current Gain	h _{FE}	V _{CE} = 10V, I _C = 5.0mA	MUN5311DW	35	60	-	
			MUN5312DW	60	100		
			MUN5313DW	80	140		
			MUN5314DW	80	140		
			MUN5315DW	160	350		
			MUN5316DW	160	350		
			MUN5330DW	3.0	5.0		
			MUN5331DW	8.0	15		
			MUN5332DW	15	30		
			MUN5333DW	80	200		
			MUN5334DW	80	150		
			MUN5335DW	80	140		
Collector-Emitter Saturation Voltage	V _{CE(sat)}	I _C = 10mA, I _B = 0.3mA	-	-	0.25	Vdc	
		I _C = 10mA, I _B = 5mA					MUN5330DW
							MUN5331DW
		I _C = 10mA, I _B = 1mA					MUN5315DW
							MUN5316DW
							MUN5332DW
							MUN5333DW
MUN5334DW							

NOTE3: Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%



Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage (on)	V _{OL}	V _{CC} = 5.0V, V _B = 2.5V, R _L = 1.0kΩ	-	-	0.2	Vdc	
							MUN5311DW
							MUN5312DW
							MUN5314DW
							MUN5315DW
							MUN5316DW
							MUN5330DW
							MUN5331DW
							MUN5332DW
							MUN5333DW
		MUN5334DW					
MUN5335DW							
		V _{CC} = 5.0V, V _B = 3.5V, R _L = 1.0kΩ				MUN5313DW	
Output Voltage (off)	V _{OH}	V _{CC} =5.0V, V _B =0.5 V, R _L =1.0kΩ		4.9	-	-	Vdc
		V _{CC} = 5.0V, V _B = 0.05V, R _L = 1.0kΩ	MUN5330DW				
		V _{CC} = 5.0V, V _B = 0.25V, R _L = 1.0kΩ	MUN5315DW				
			MUN5316DW				
						MUN5333DW	

NOTE3: Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%



Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Resistor	R ₁	MUN5311DW	7.0	10	13	kΩ
		MUN5312DW	15.4	22	28.6	
		MUN5313DW	32.9	47	61.1	
		MUN5314DW	7.0	10	13	
		MUN5315DW	7.0	10	13	
		MUN5316DW	3.3	4.7	6.1	
		MUN5330DW	0.7	1.0	1.3	
		MUN5331DW	1.5	2.2	2.9	
		MUN5332DW	3.3	4.7	6.1	
		MUN5333DW	3.3	4.7	6.1	
		MUN5334DW	15.4	22	28.6	
		MUN5335DW	1.54	2.2	2.86	
Resistor Ratio	R ₁ /R ₂	MUN5311DW	0.8	1.0	1.2	
		MUN5312DW				
		MUN5313DW				
		MUN5314DW	0.17	0.21	0.25	
		MUN5315DW	-	-	-	
		MUN5316DW				
		MUN5330DW	0.8	1.0	1.2	
		MUN5331DW				
		MUN5332DW				
		MUN5333DW	0.055	0.1	0.185	
		MUN5334DW	0.38	0.47	0.56	
		MUN5335DW	0.038	0.047	0.056	

NOTE3: Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%



Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit	
OFF CHARACTERISTICS							
Collector-Base Cutoff Current	I_{CBO}	$V_{CB} = 50V, I_E = 0$	-	-	100	nAdc	
Collector-Emitter Cutoff Current	I_{CEO}	$V_{CE} = 50V, I_B = 0$	-	-	500	nAdc	
Emitter-Base Cutoff Current	I_{EBO}	$V_{EB} = 6.0V, I_C = 0$	-	-	0.5	mAdc	
					MUN5312DW		0.2
					MUN5313DW		0.1
					MUN5314DW		0.2
					MUN5315DW		0.9
					MUN5316DW		1.9
					MUN5330DW		4.3
					MUN5331DW		2.3
					MUN5332DW		1.5
					MUN5333DW		0.18
					MUN5334DW		0.13
MUN5335DW	0.2						
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu A, I_E = 0$	50	-	-	Vdc	
Collector-Emitter Breakdown Voltage <small>NOTE 3</small>	$V_{(BR)CEO}$	$I_C = 2.0mA, I_B = 0$	50	-	-	Vdc	

NOTE3: Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%



TYPICAL CHARACTERISTICS

MUN5311DW~MUN5335DW

Figure 1. Derating Curve

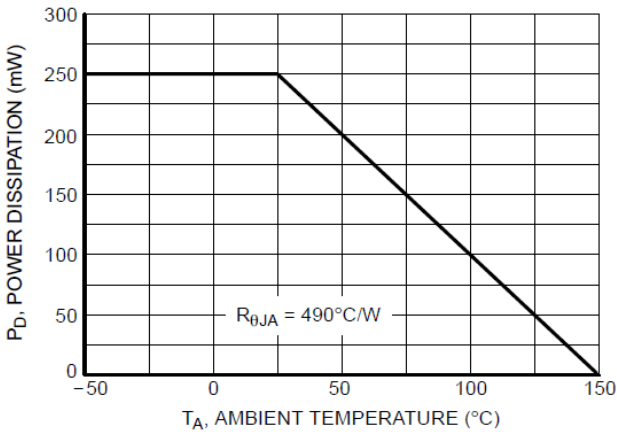


Figure 3. DC Current Gain

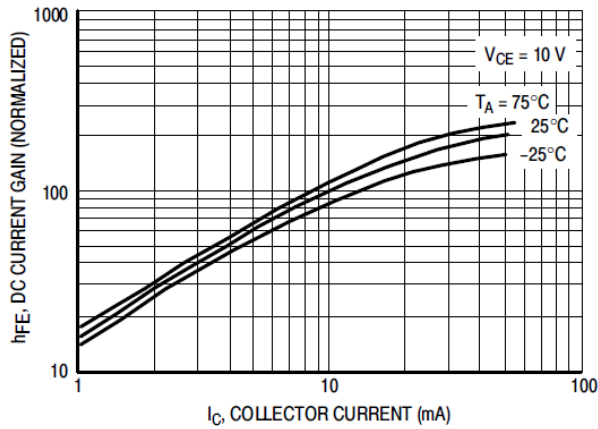
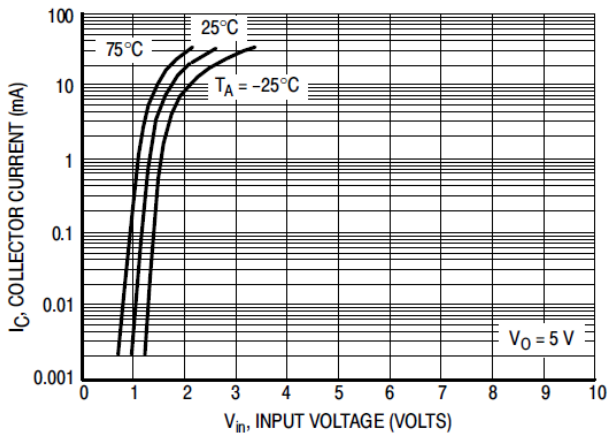


Figure 5. Output Current vs. Input Voltage



MUN5311DW NPN TRANSISTOR

Figure 2. V_{CE(sat)} vs. I_c

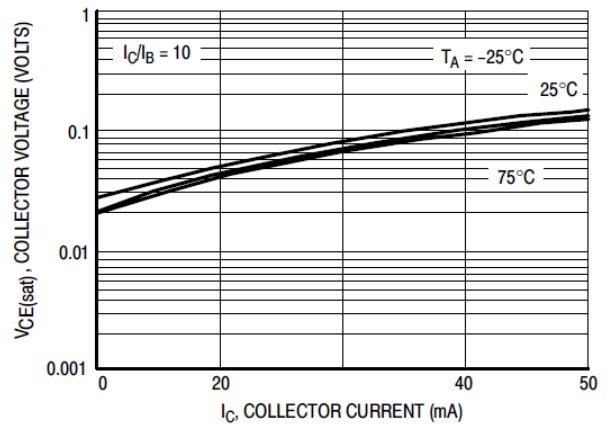


Figure 4. Output Capacitance

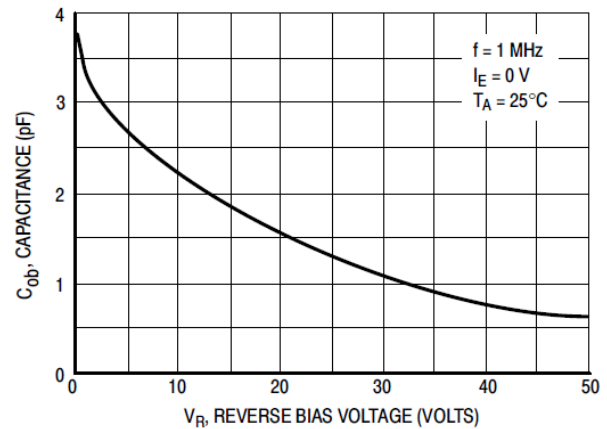
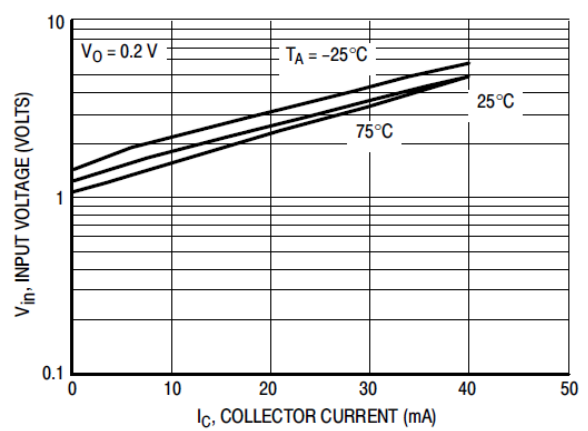


Figure 6. Input Voltage vs. Output Current





MUN5311DW PNP TRANSISTOR

Figure 7. $V_{CE(sat)}$ vs. I_C

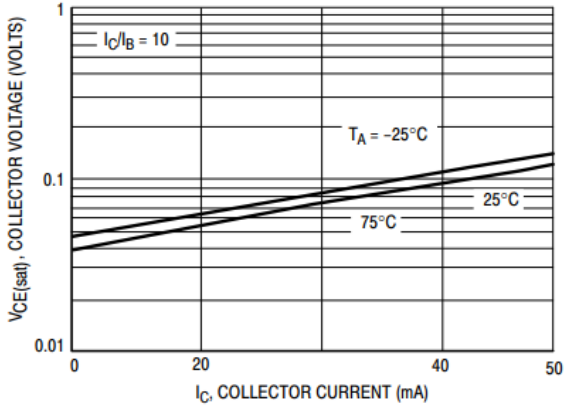


Figure 8. DC Current Gain

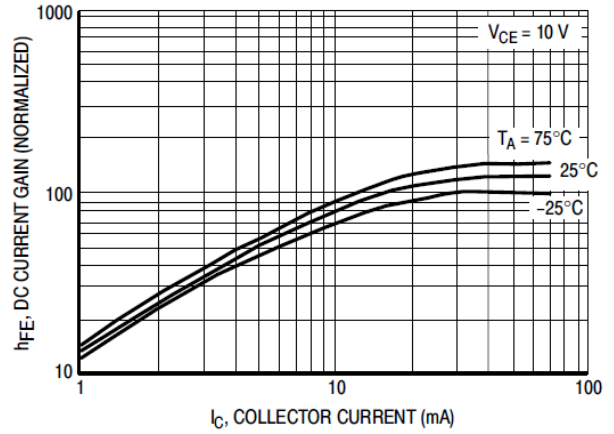


Figure 9. Output Capacitance

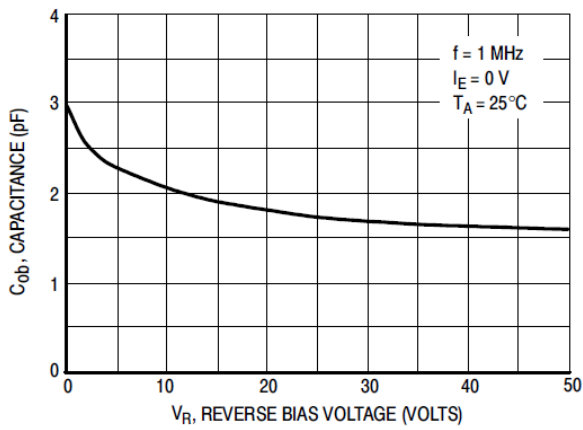


Figure 10. Output Current vs. Input Voltage

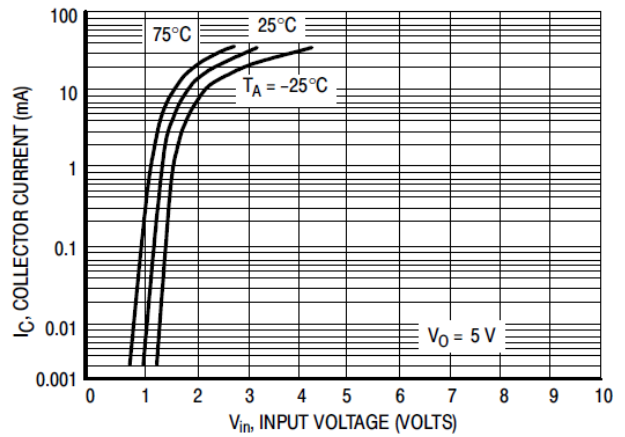
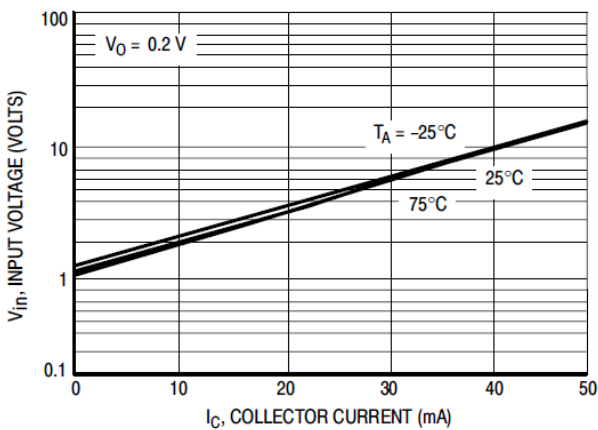


Figure 11. Input Voltage vs. Output Current





MUN5312DW NPN TRANSISTOR

Figure 12. $V_{CE(sat)}$ vs. I_C

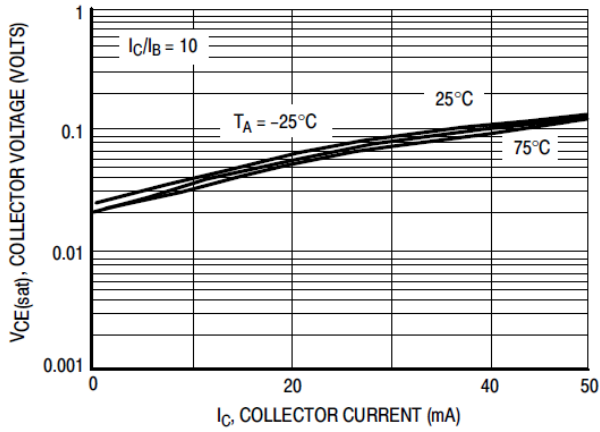


Figure 13. DC Current Gain

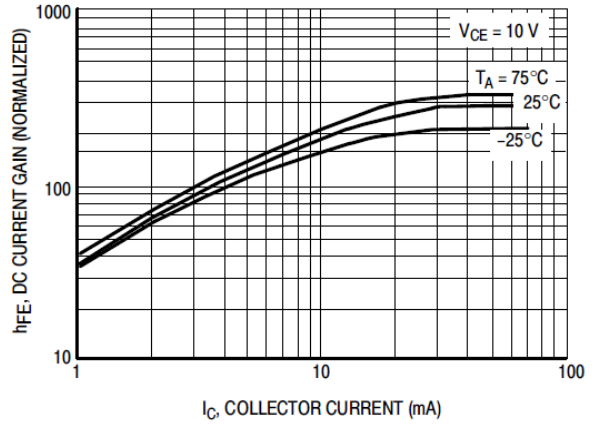


Figure 14. Output Capacitance

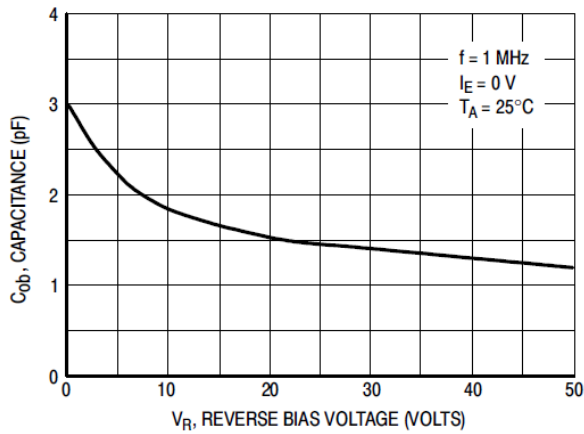


Figure 15. Output Current vs. Input Voltage

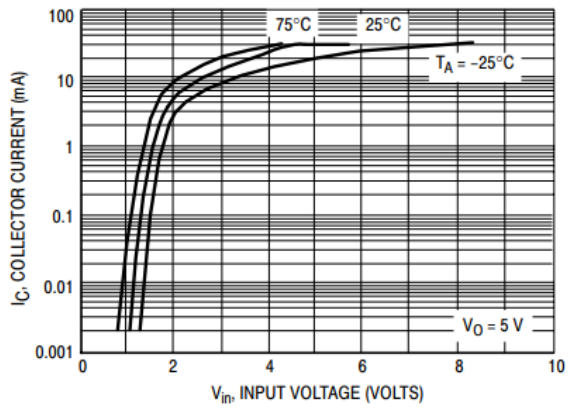
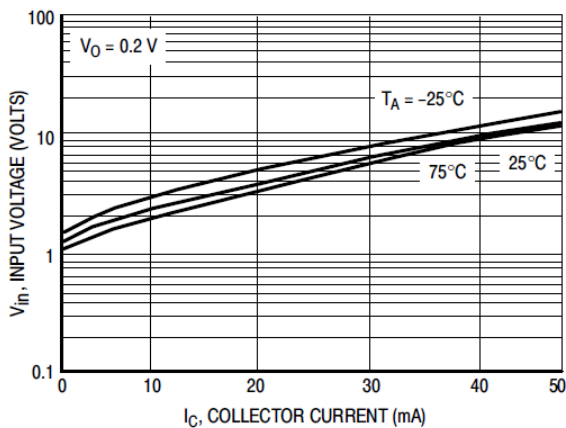


Figure 16. Input Voltage vs. Output Current





MUN5312DW PNP TRANSISTOR

Figure 17. $V_{CE(sat)}$ vs. I_C

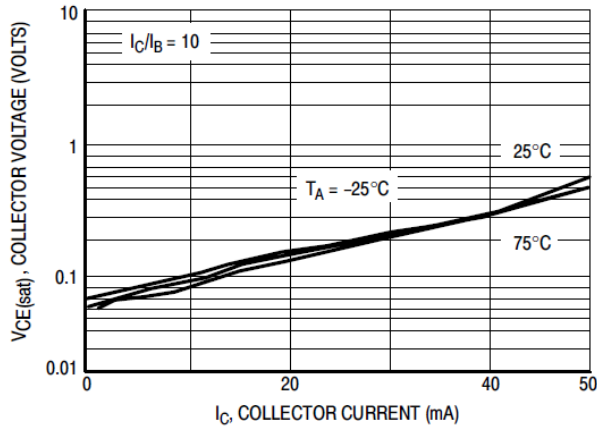


Figure 18. DC Current Gain

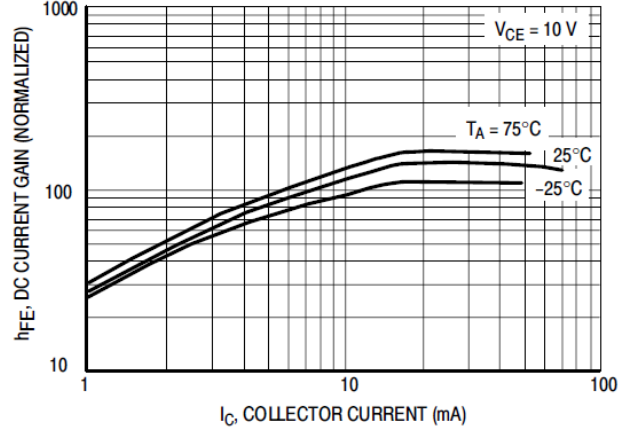


Figure 19. Output Capacitance

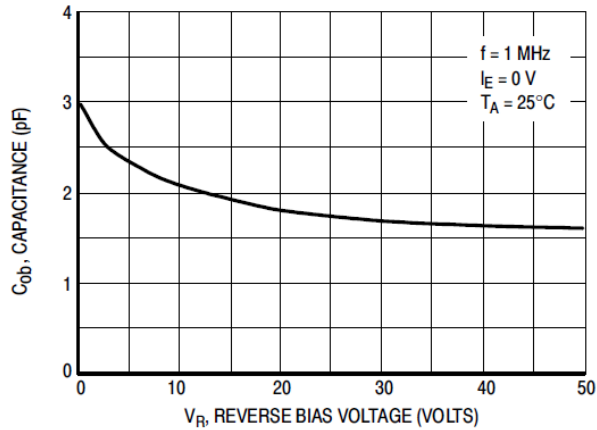


Figure 20. Output Current vs. Input Voltage

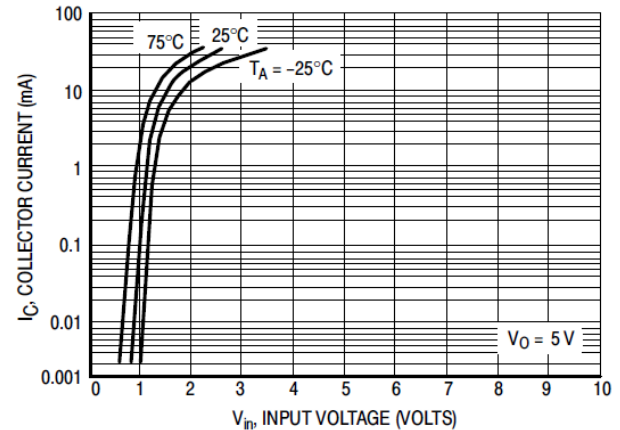
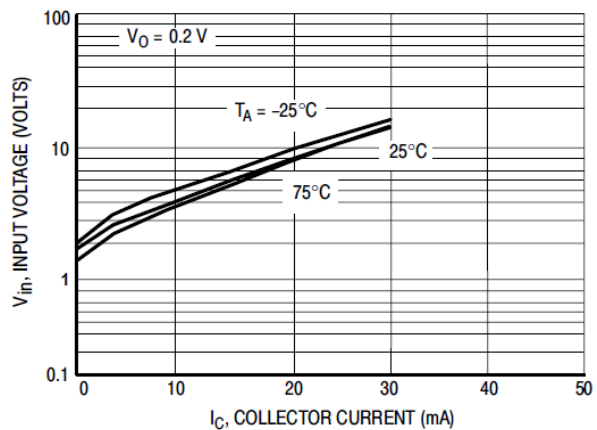


Figure 21. Input Voltage vs. Output Current





MUN5313DW NPN TRANSISTOR

Figure 22. $V_{CE(sat)}$ vs. I_C

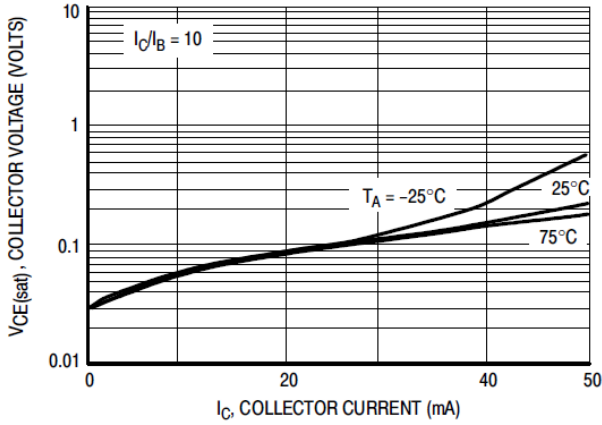


Figure 23. DC Current Gain

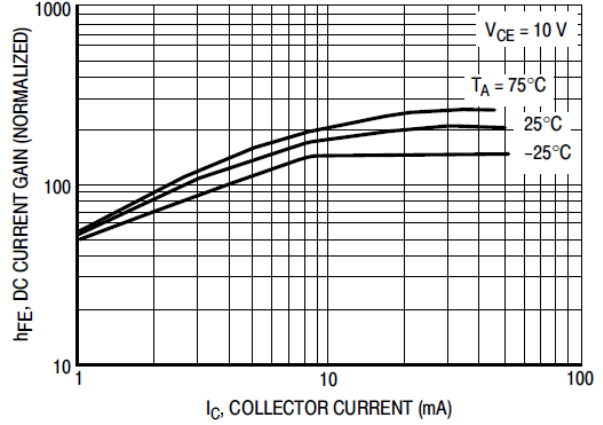


Figure 24. Output Capacitance

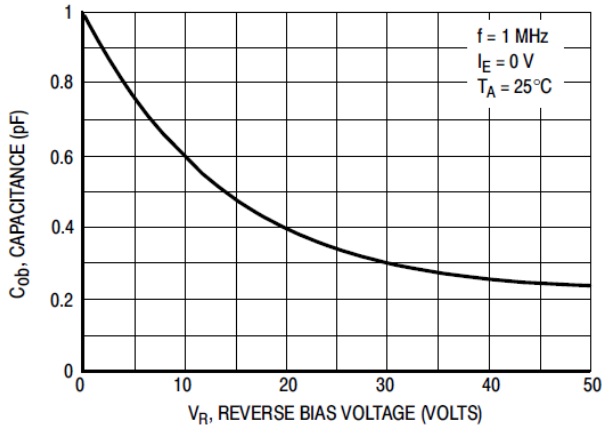


Figure 25. Output Current vs. Input Voltage

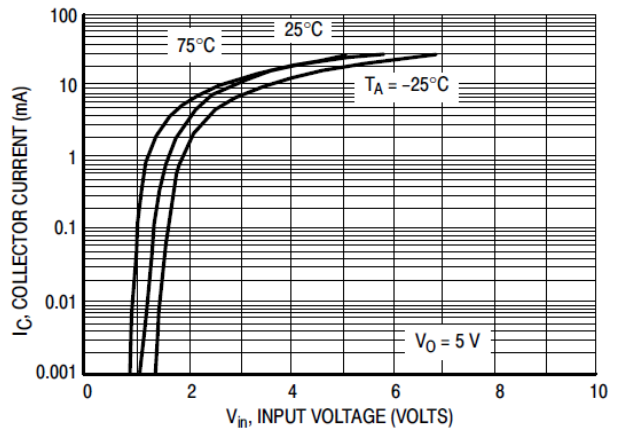
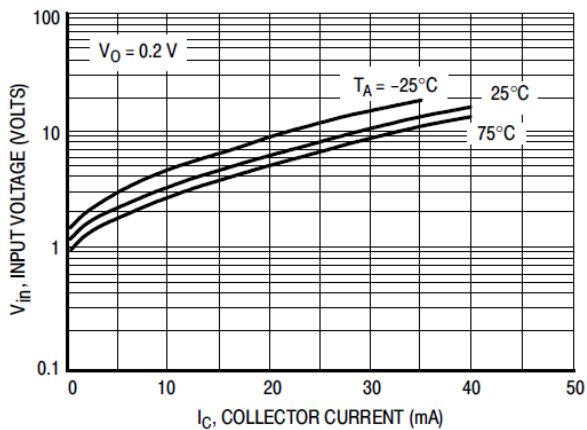


Figure 26. Input Voltage vs. Output Current





MUN5313DW PNP TRANSISTOR

Figure 27. $V_{CE(sat)}$ vs. I_C

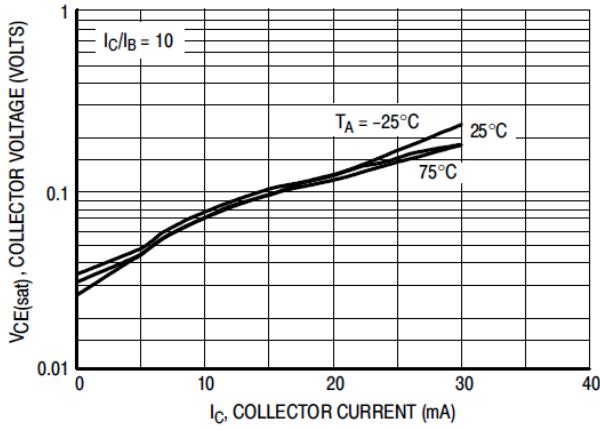


Figure 28. DC Current Gain

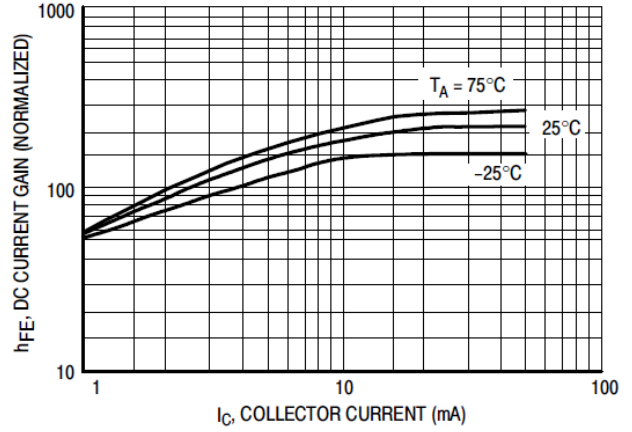


Figure 29. Output Capacitance

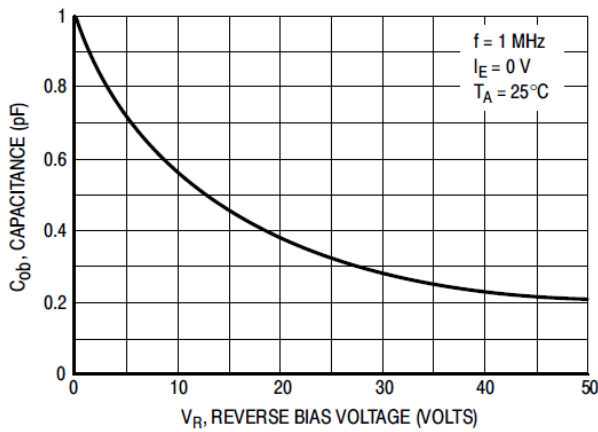


Figure 30. Output Current vs. Input Voltage

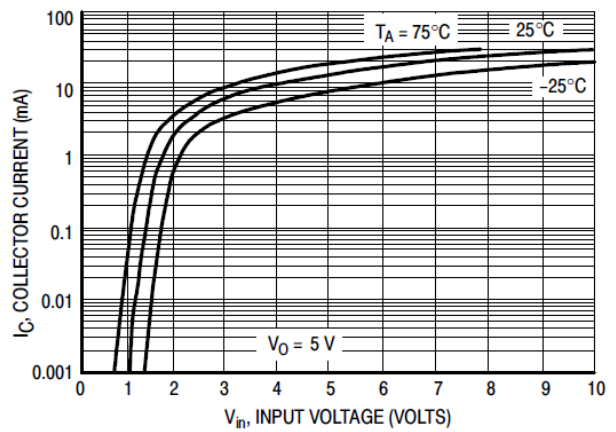
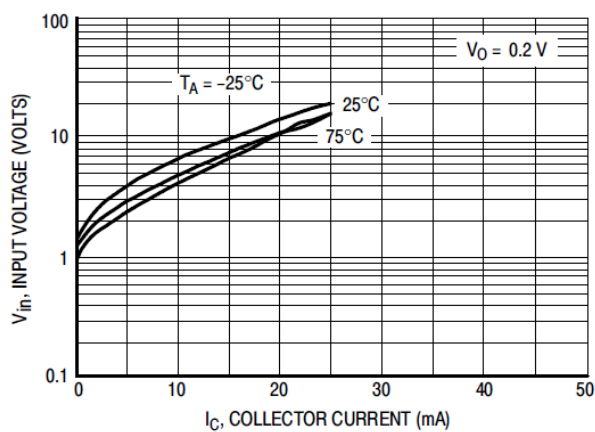


Figure 31. Input Voltage vs. Output Current





MUN5314DW NPN TRANSISTOR

Figure 32. $V_{CE(sat)}$ vs. I_C

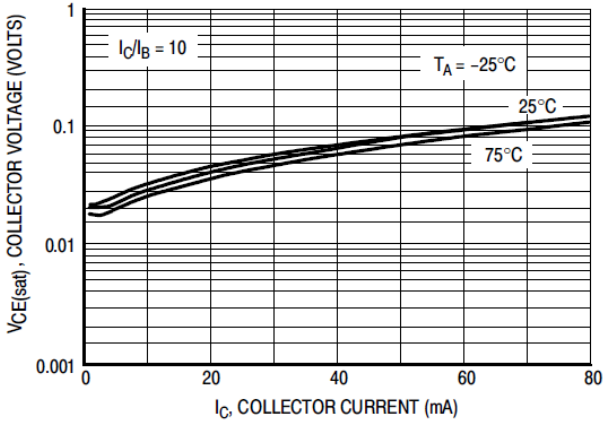


Figure 33. DC Current Gain

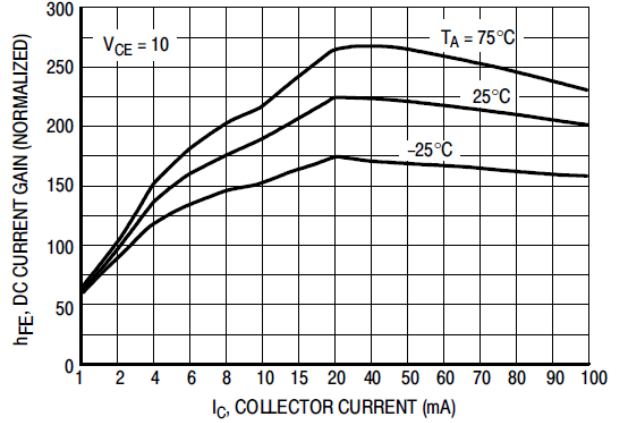


Figure 34. Output Capacitance

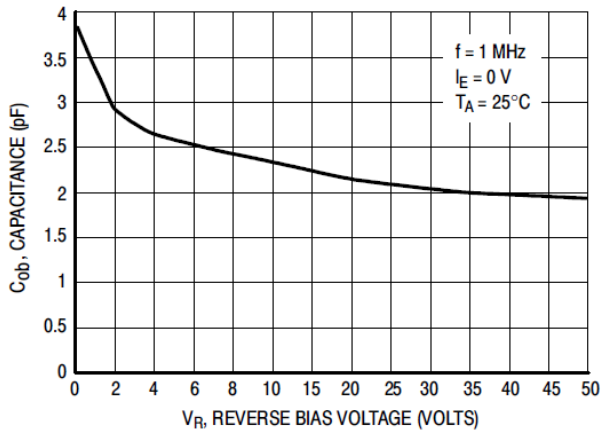


Figure 35. Output Current vs. Input Voltage

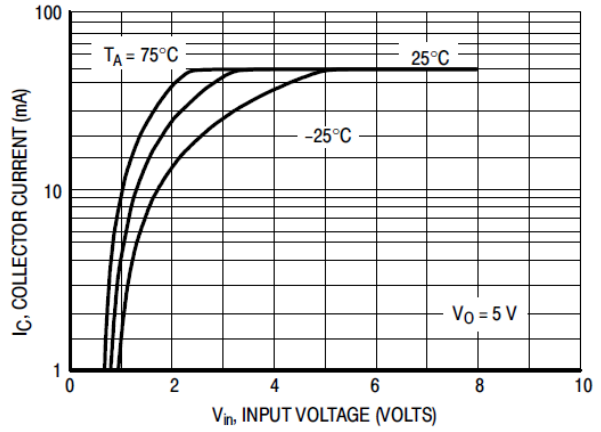
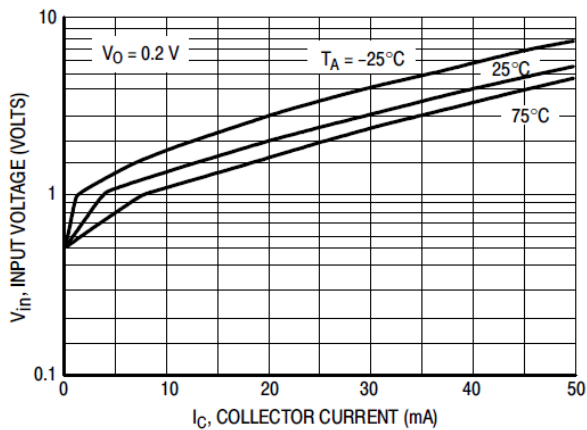


Figure 36. Input Voltage vs. Output Current





MUN5314DW PNP TRANSISTOR

Figure 37. $V_{CE(sat)}$ vs. I_C

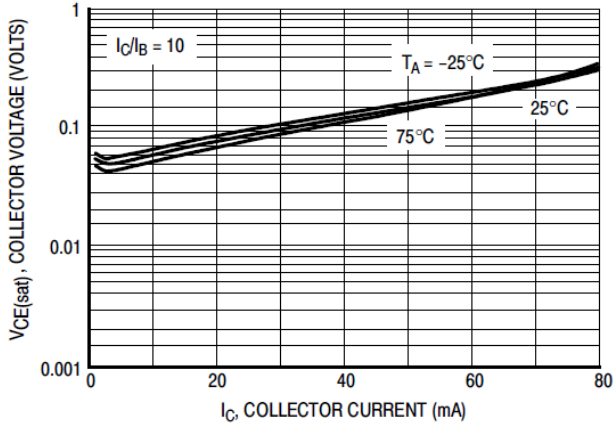


Figure 38. DC Current Gain

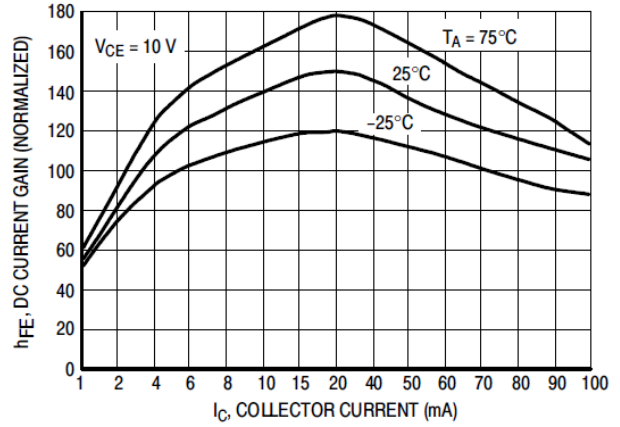


Figure 39. Output Capacitance

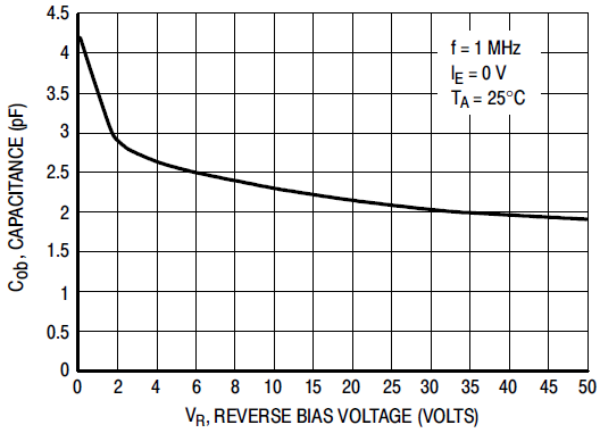


Figure 40. Output Current vs. Input Voltage

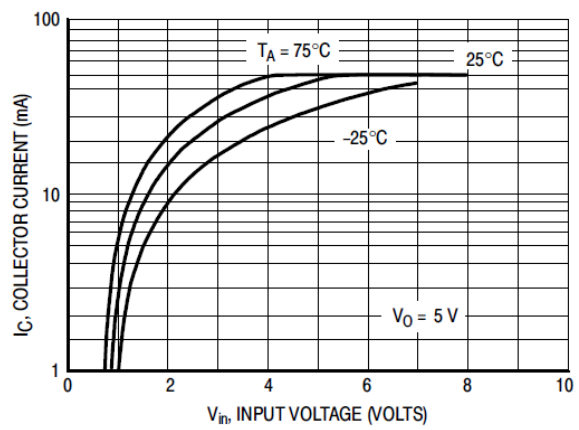
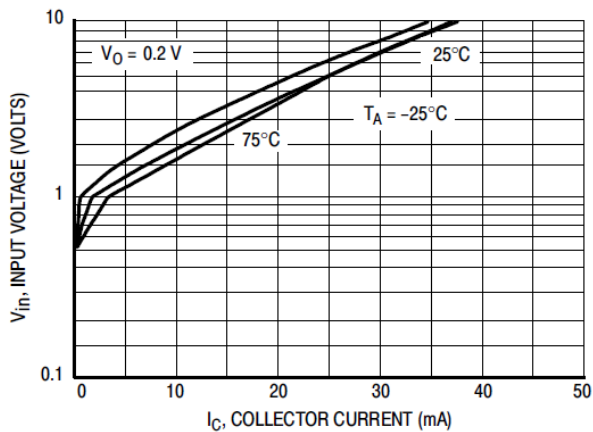


Figure 41. Input Voltage vs. Output Current





MUN5315DW NPN TRANSISTOR

Figure 42. $V_{CE(sat)}$ vs. I_C

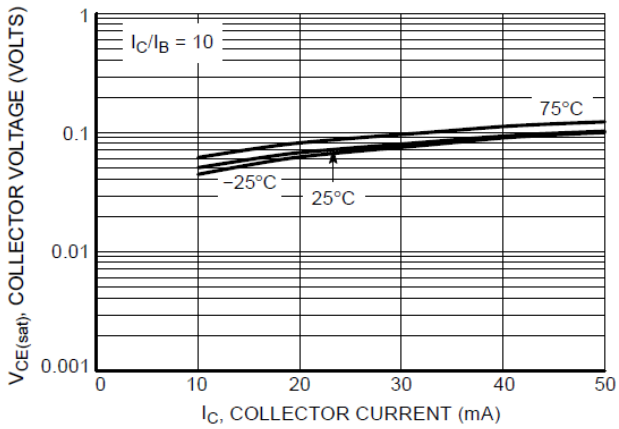


Figure 43. DC Current Gain

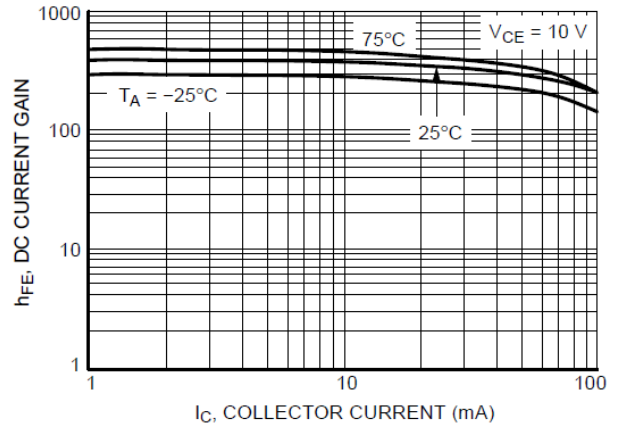


Figure 44. Output Capacitance

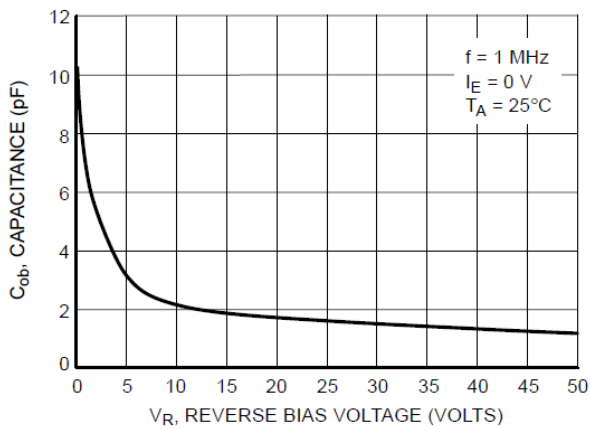


Figure 45. Output Current vs. Input Voltage

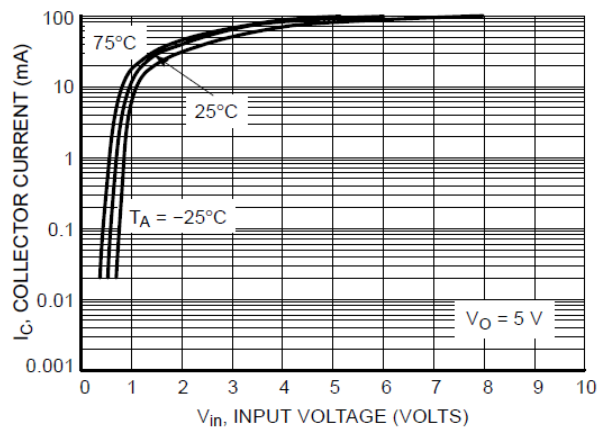
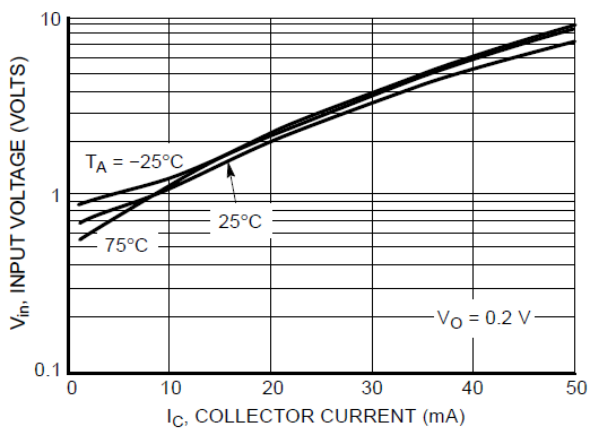


Figure 46. Input Voltage vs. Output Current





MUN5315DW PNP TRANSISTOR

Figure 47. $V_{CE(sat)}$ vs. I_C

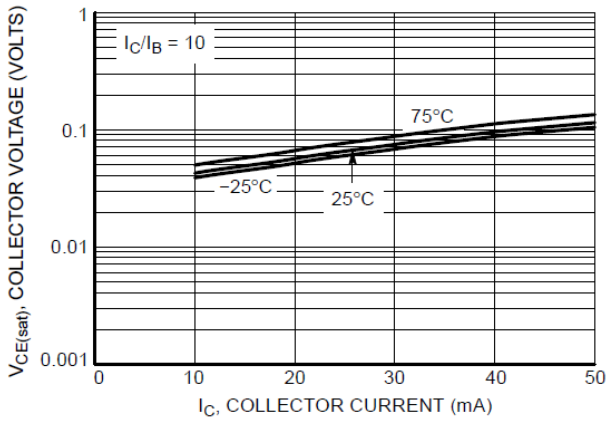


Figure 48. DC Current Gain

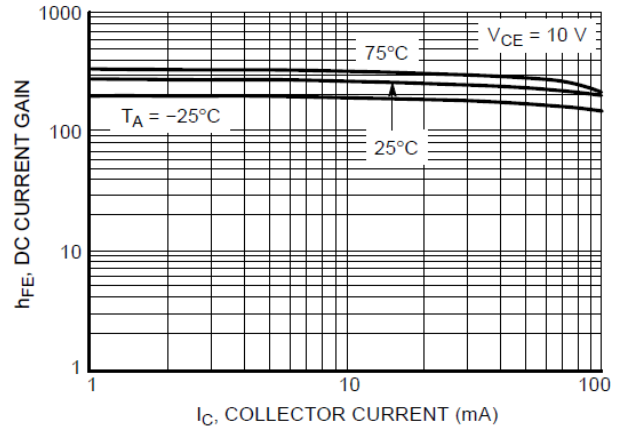


Figure 49. Output Capacitance

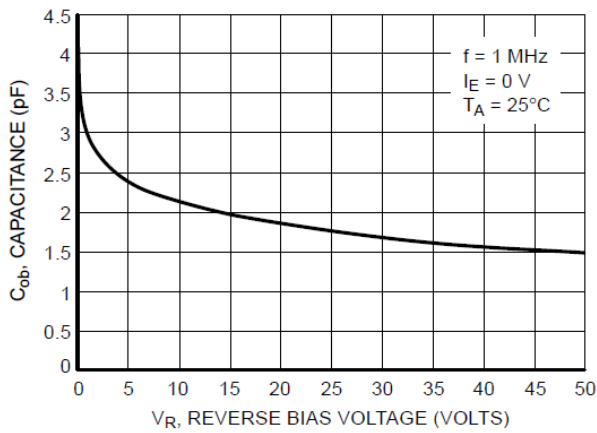


Figure 50. Output Current vs. Input Voltage

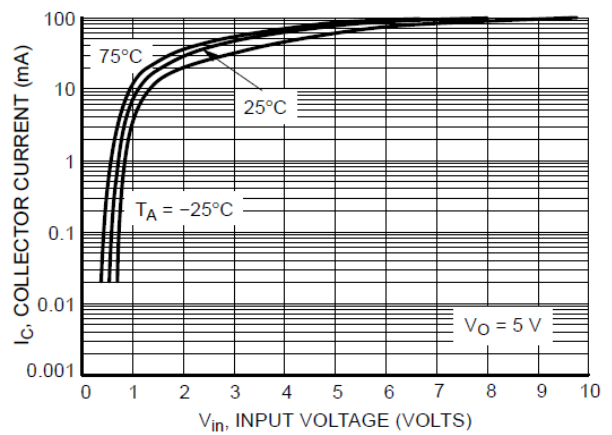
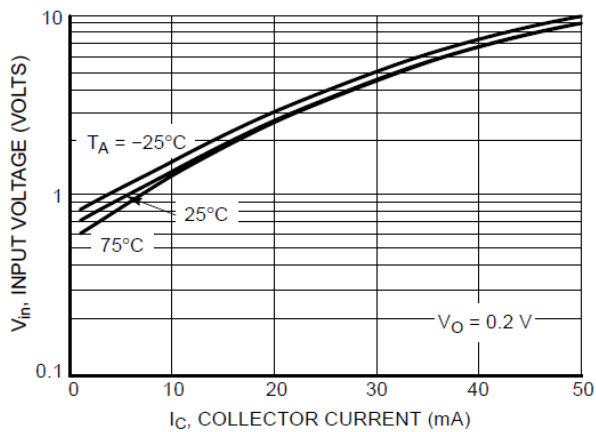


Figure 51. Input Voltage vs. Output Current





MUN5316DW NPN TRANSISTOR

Figure 52. $V_{CE(sat)}$ vs. I_C

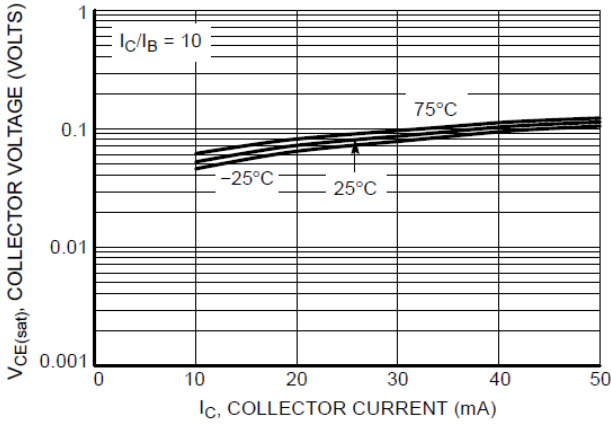


Figure 53. DC Current Gain

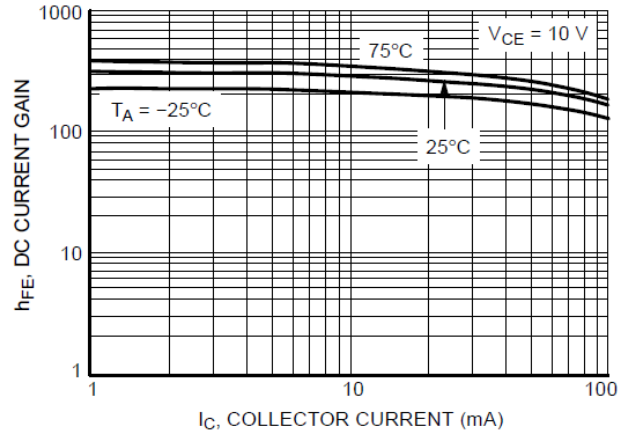


Figure 54. Output Capacitance

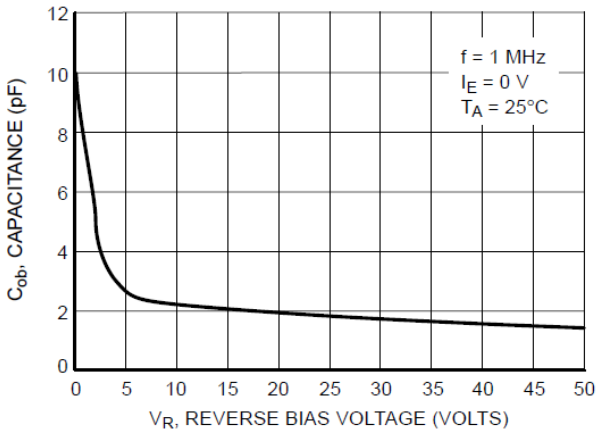


Figure 55. Output Current vs. Input Voltage

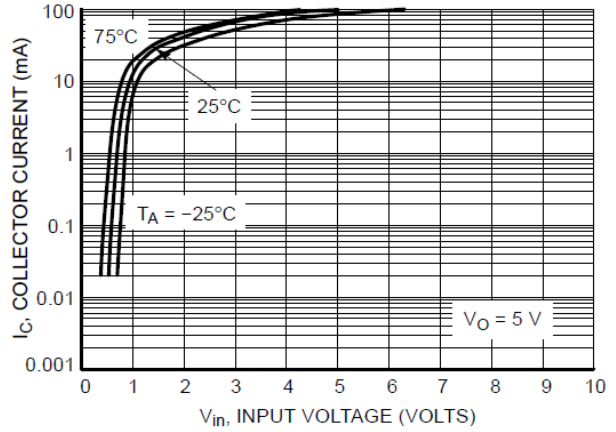
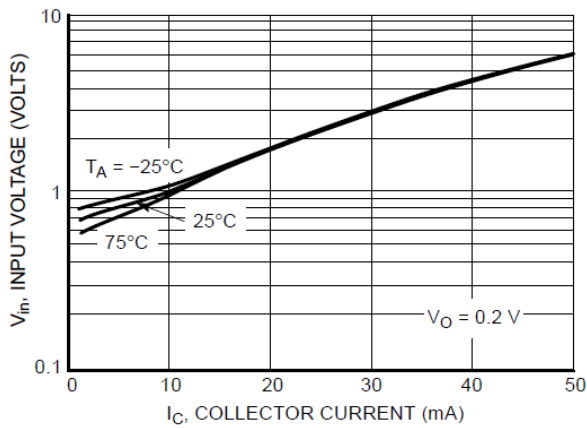


Figure 56. Input Voltage vs. Output Current





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Figure 57. $V_{CE(sat)}$ vs. I_C

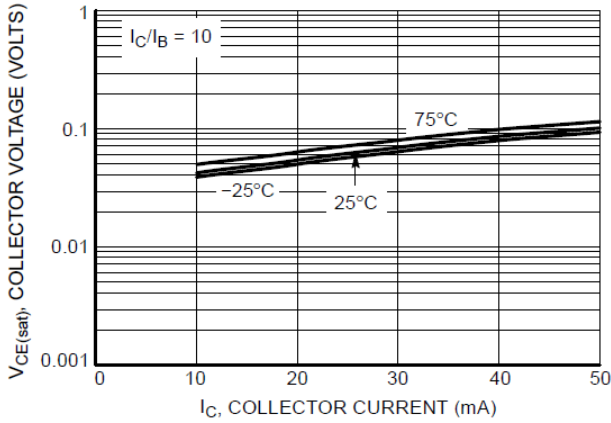


Figure 58. DC Current Gain

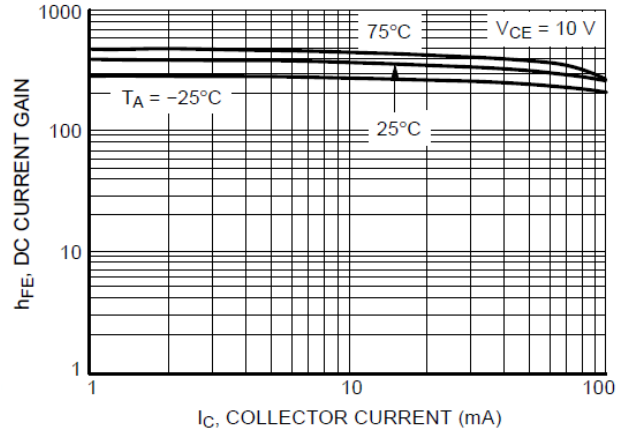


Figure 59. Output Capacitance

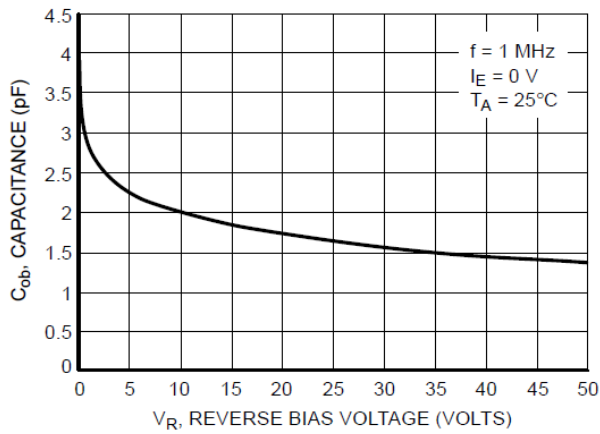


Figure 60. Output Current vs. Input Voltage

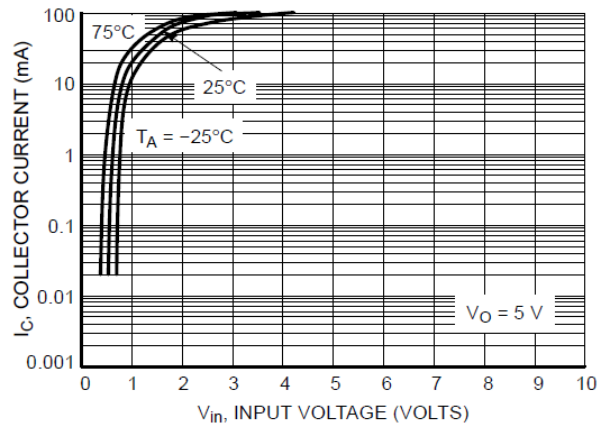
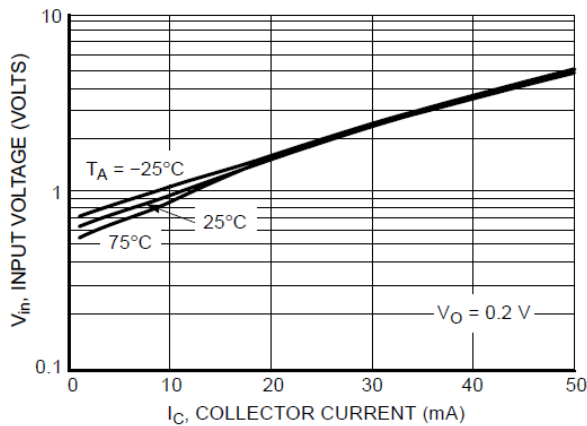


Figure 61. Input Voltage vs. Output Current





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Figure 62. $V_{CE(sat)}$ vs. I_C

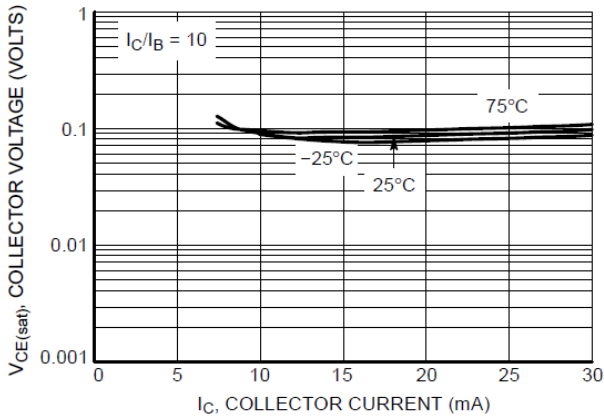


Figure 63. DC Current Gain

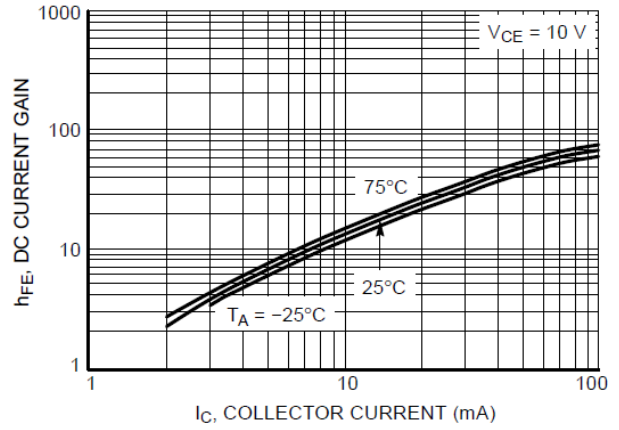


Figure 64. Output Current versus Input Voltage

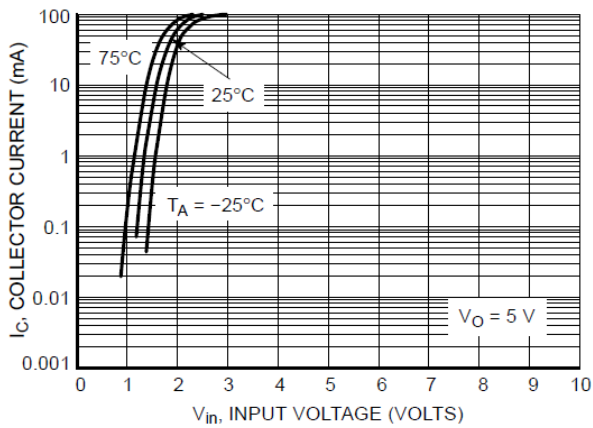
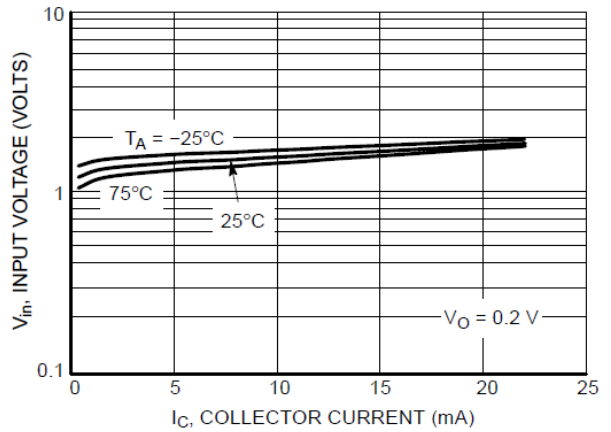


Figure 65. Input Voltage versus Output Current





MUN5330DW PNP TRANSISTOR

Figure 66. $V_{CE(sat)}$ vs. I_C

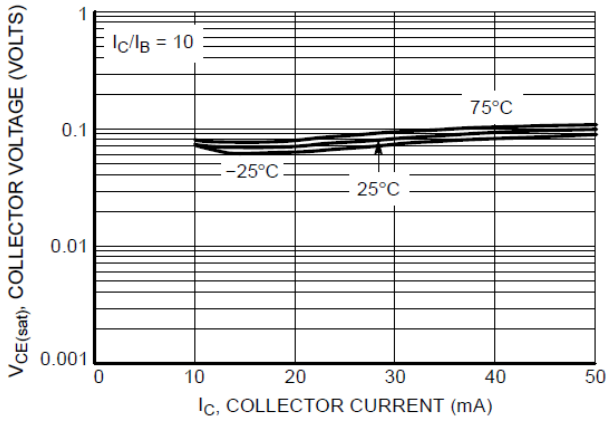


Figure 67. DC Current Gain

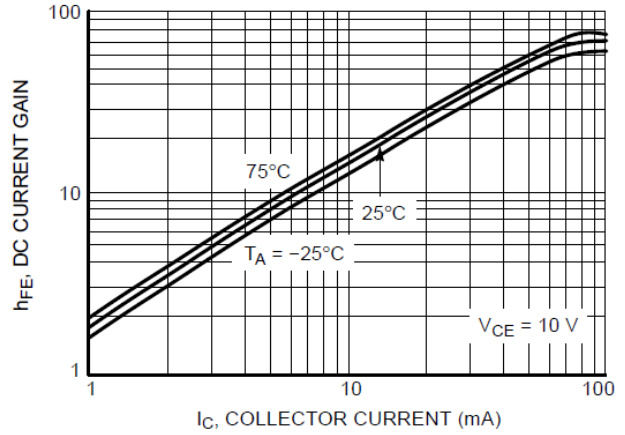


Figure 68. Output Capacitance

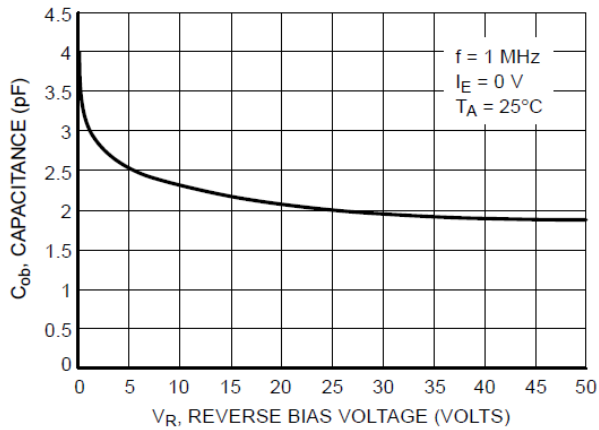


Figure 69. Output Current versus Input Voltage

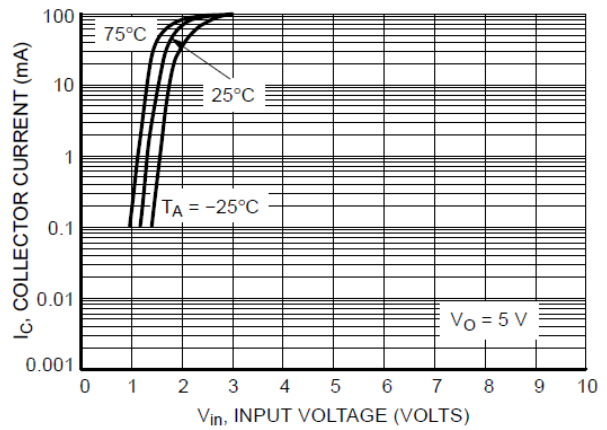
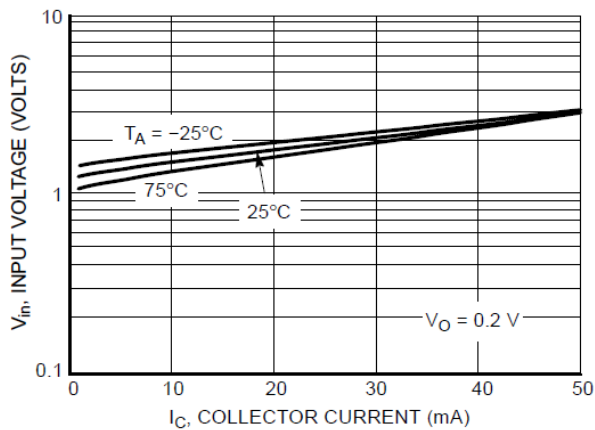


Figure 70. Input Voltage versus Output Current





MUN5331DW NPN TRANSISTOR

Figure 71. $V_{CE(sat)}$ vs. I_C

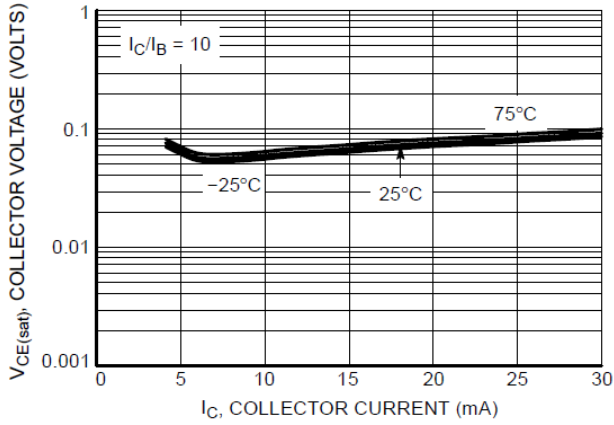


Figure 72. DC Current Gain

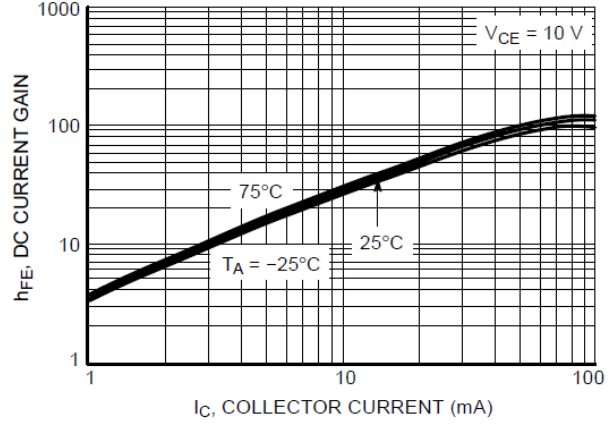


Figure 73. Output Capacitance

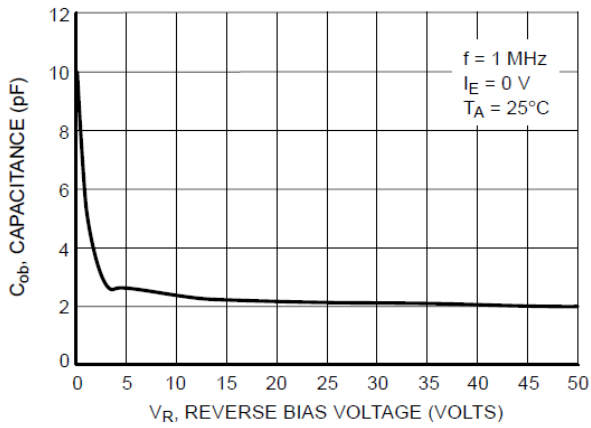


Figure 74. Output Current vs. Input Voltage

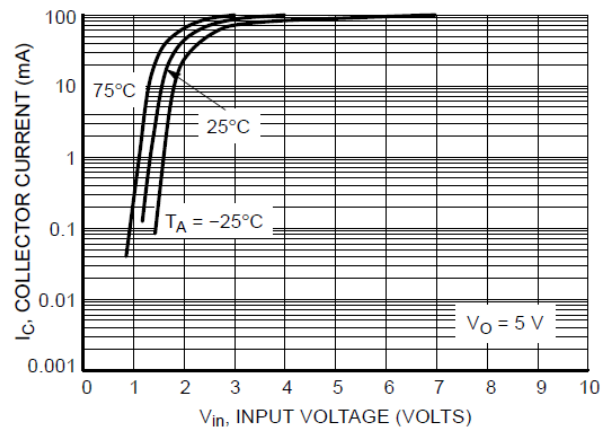
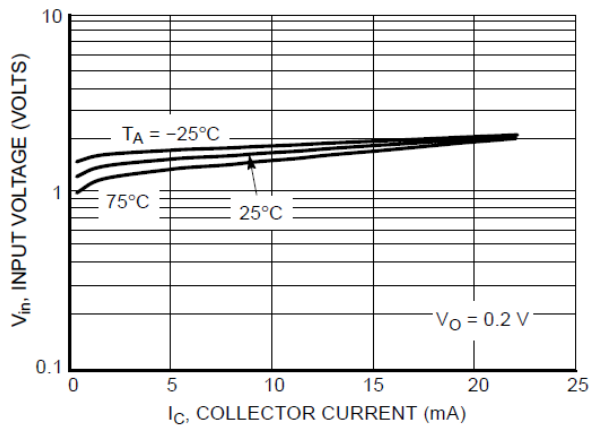


Figure 75. Input Voltage vs. Output Current





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Figure 76. $V_{CE(sat)}$ vs. I_C

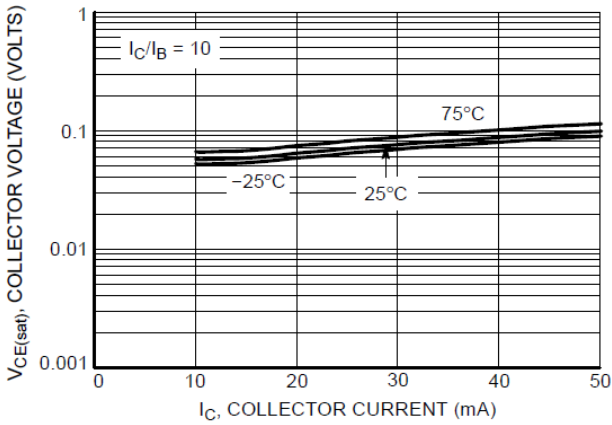


Figure 77. DC Current Gain

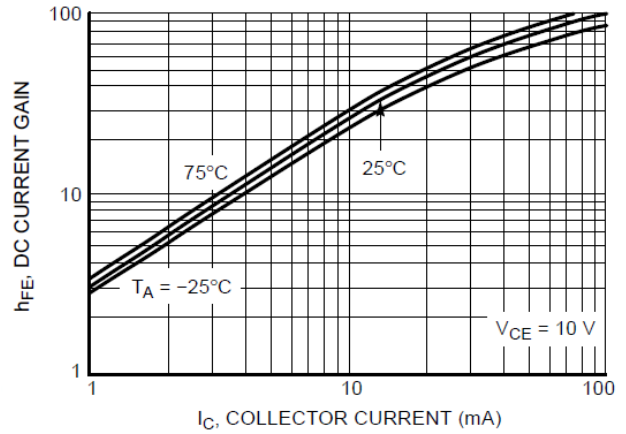


Figure 78. Output Capacitance

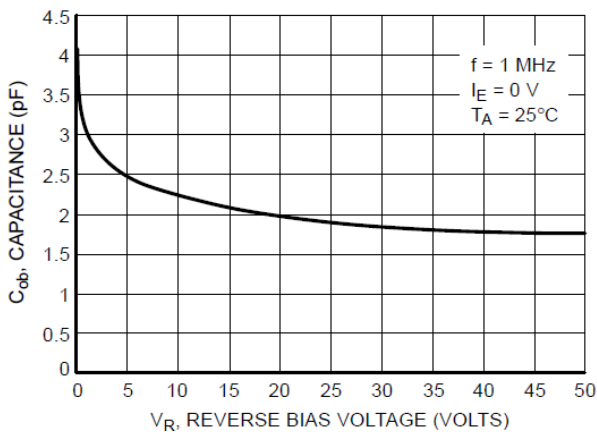


Figure 79. Output Current vs. Input Voltage

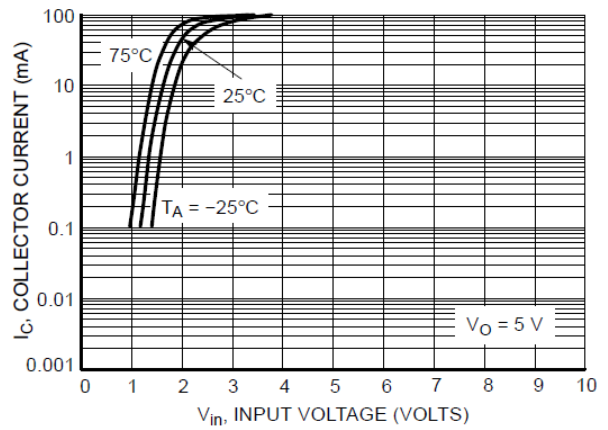
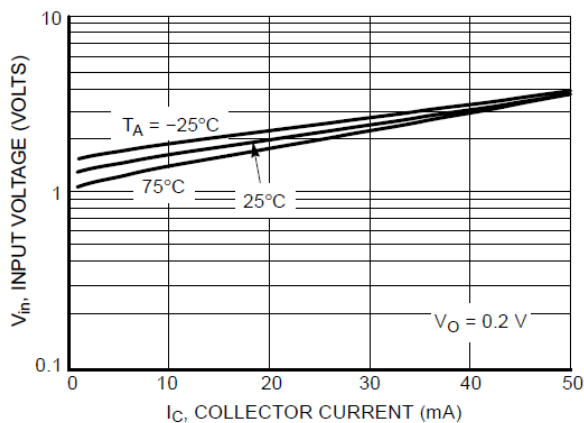


Figure 80. Input Voltage vs. Output Current





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Figure 81. $V_{CE(sat)}$ vs. I_C

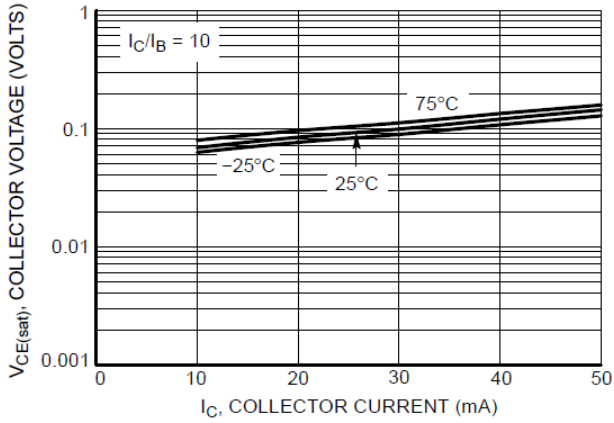


Figure 82. DC Current Gain

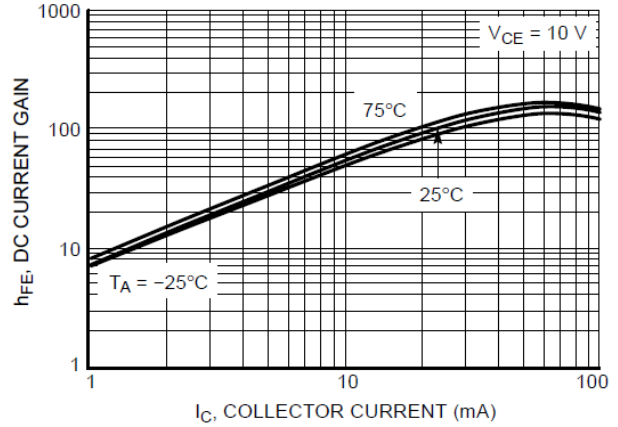


Figure 83. Output Capacitance

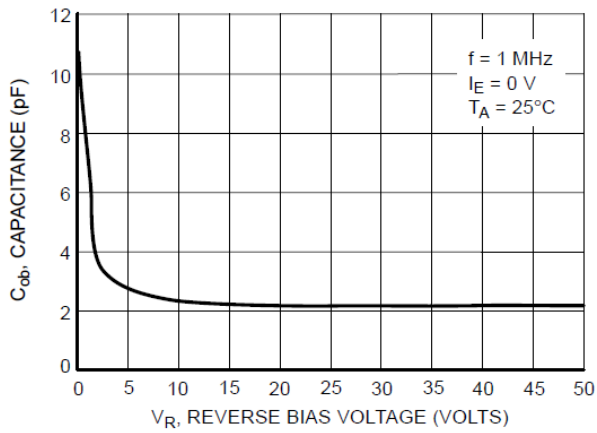


Figure 84. Output Current vs. Input Voltage

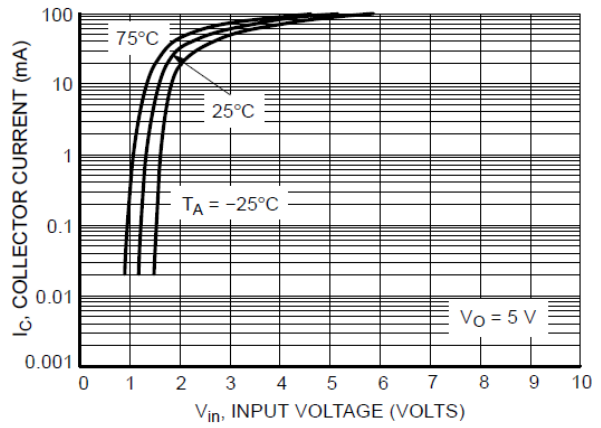
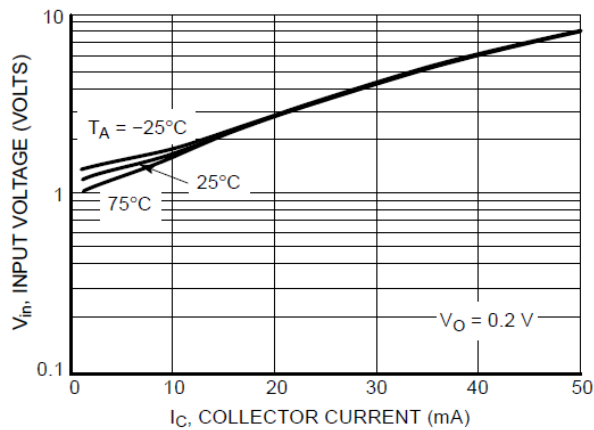


Figure 85. Input Voltage vs. Output Current





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Figure 86. $V_{CE(sat)}$ vs. I_C

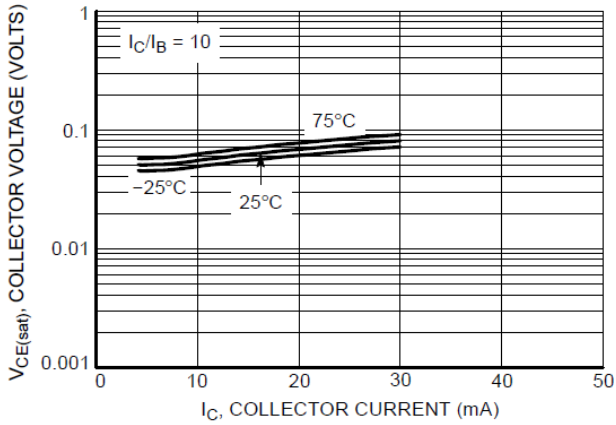


Figure 87. DC Current Gain

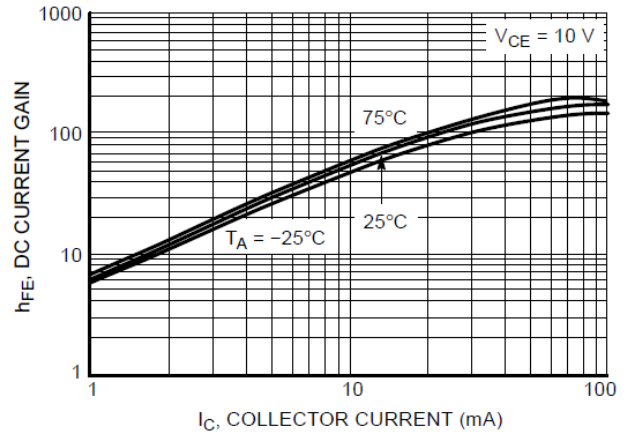


Figure 88. Output Capacitance

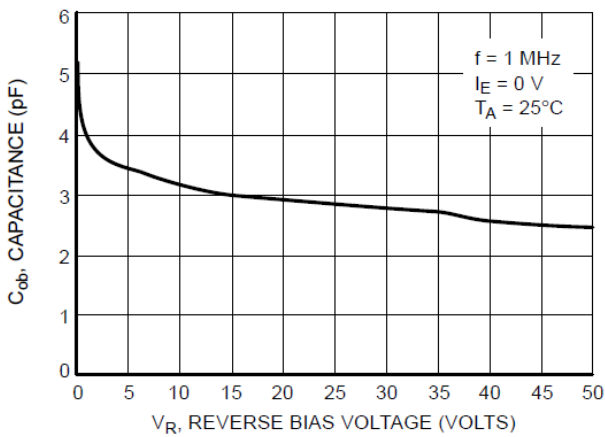


Figure 89. Output Current vs. Input Voltage

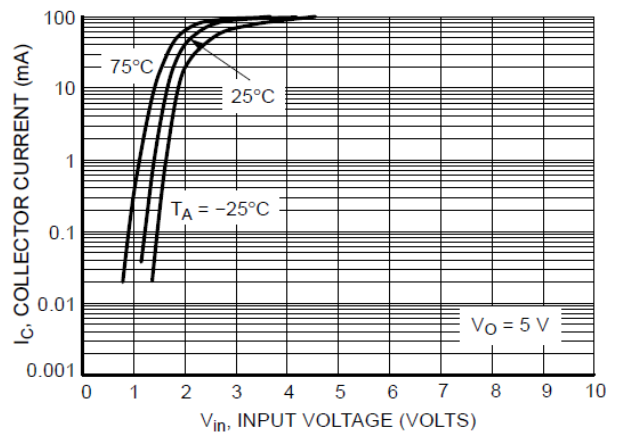
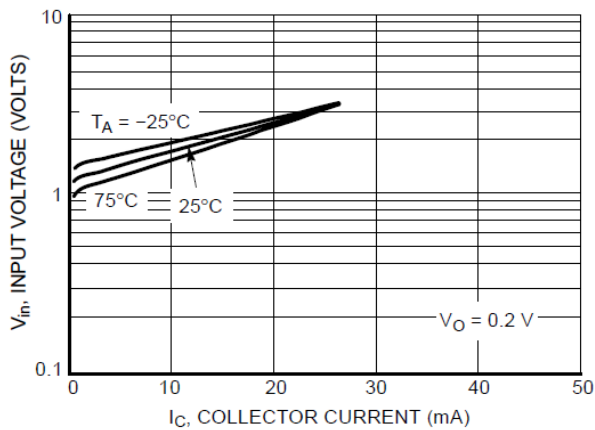


Figure 90. Input Voltage vs. Output Current





MUN5333DW NPN TRANSISTOR

Figure 91. $V_{CE(sat)}$ vs. I_C

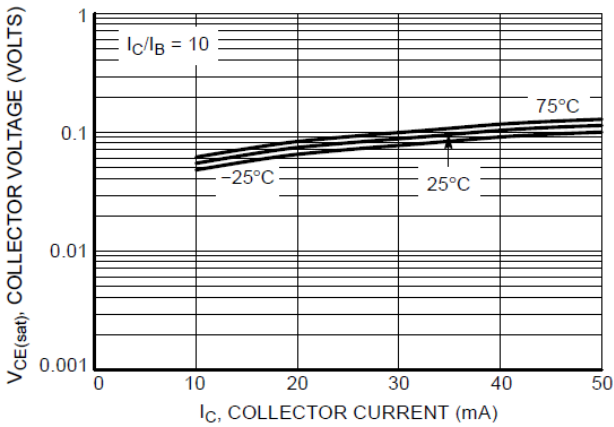


Figure 92. DC Current Gain

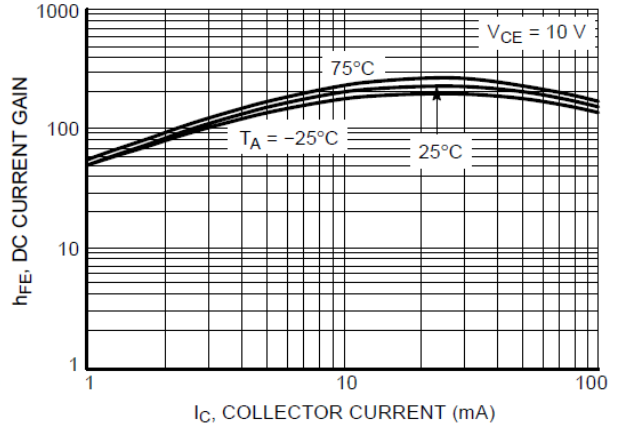


Figure 93. Output Capacitance

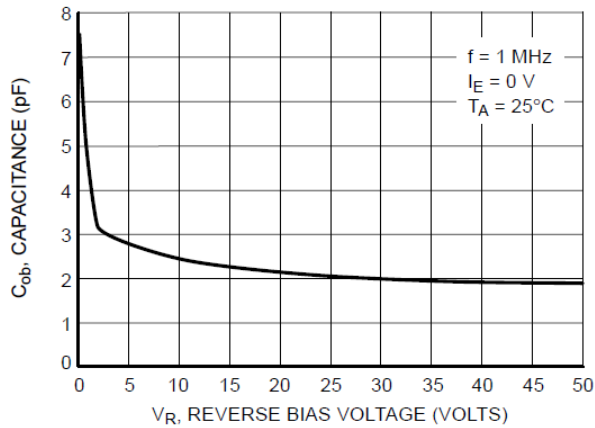


Figure 94. Output Current vs. Input Voltage

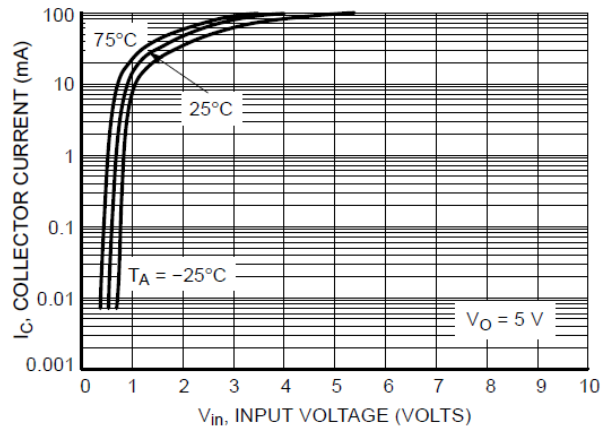
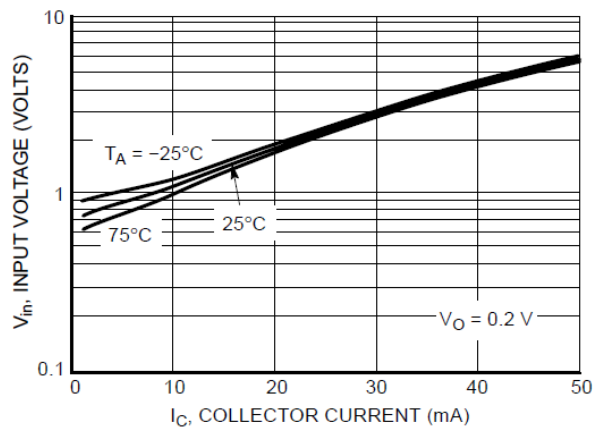


Figure 95. Input Voltage vs. Output Current





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Figure 96. $V_{CE(sat)}$ vs. I_C

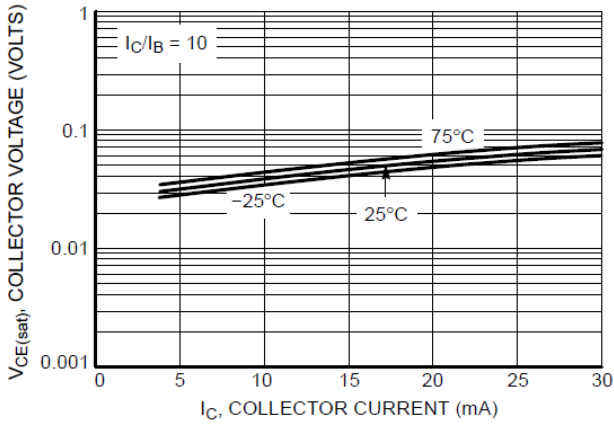


Figure 97. DC Current Gain

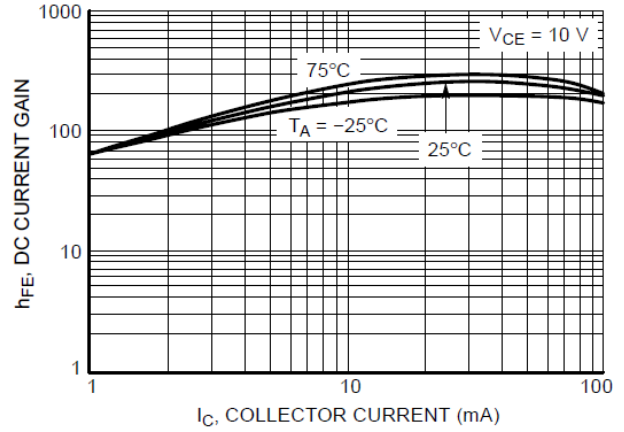


Figure 98. Output Capacitance

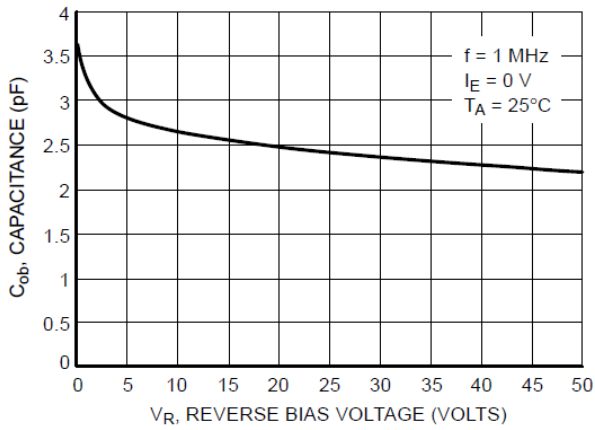


Figure 99. Output Current vs. Input Voltage

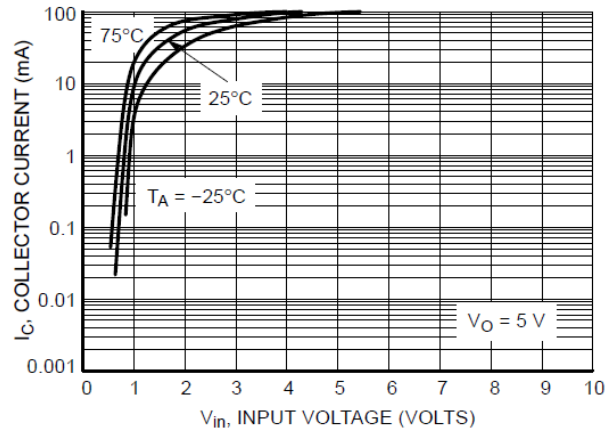
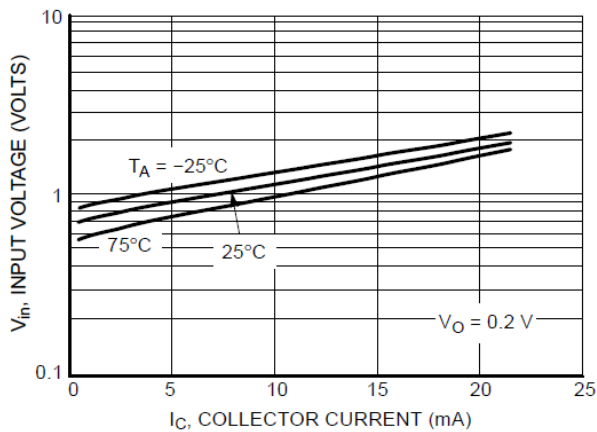


Figure 100. Input Voltage vs. Output Current





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Figure 101. $V_{CE(sat)}$ vs. I_C

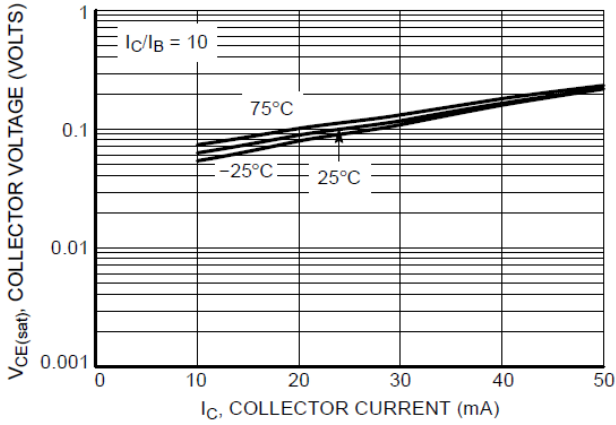


Figure 102. DC Current Gain

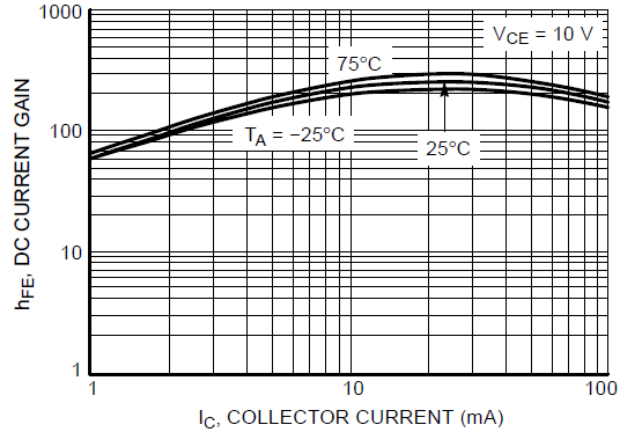


Figure 103. Output Capacitance

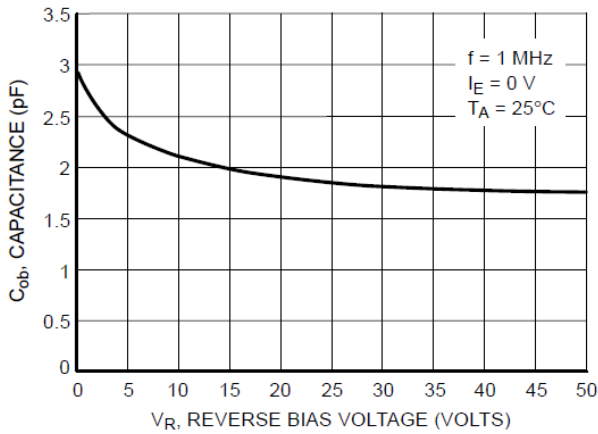


Figure 104. Output Current vs. Input Voltage

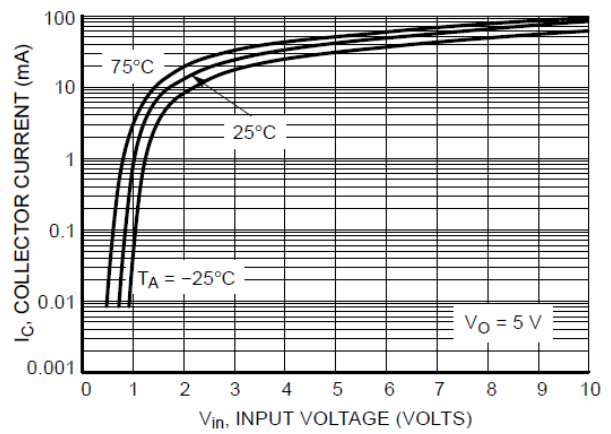
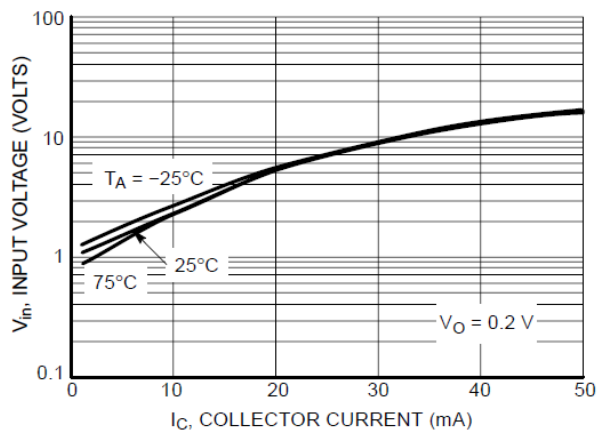


Figure 105. Input Voltage vs. Output Current





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Figure 106. $V_{CE(sat)}$ vs. I_C

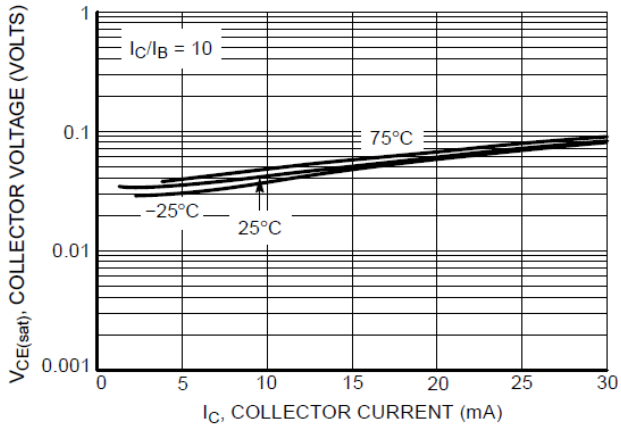
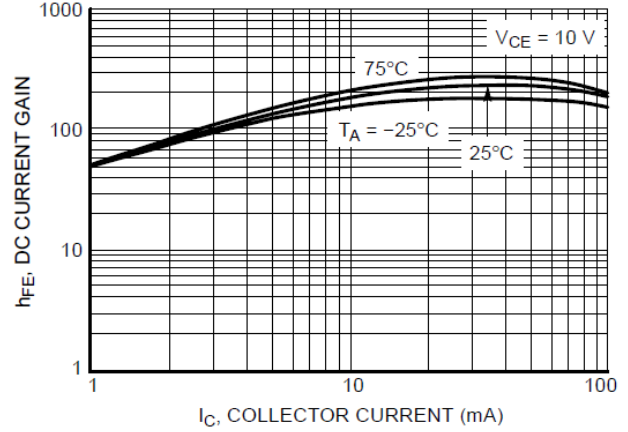


Figure 107. DC Current Gain





MUN5335DW NPN TRANSISTOR

Figure 108. $V_{CE(sat)}$ vs. I_C

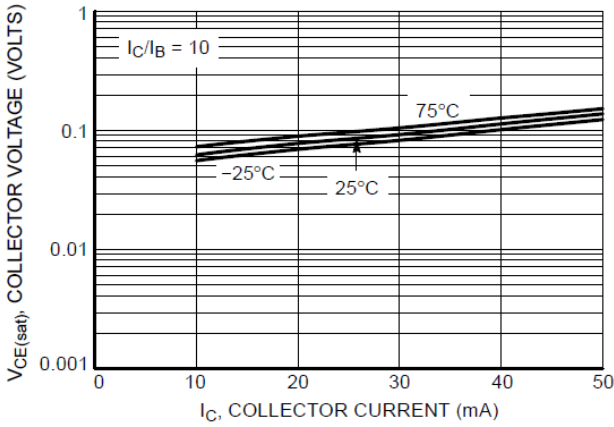


Figure 109. DC Current Gain

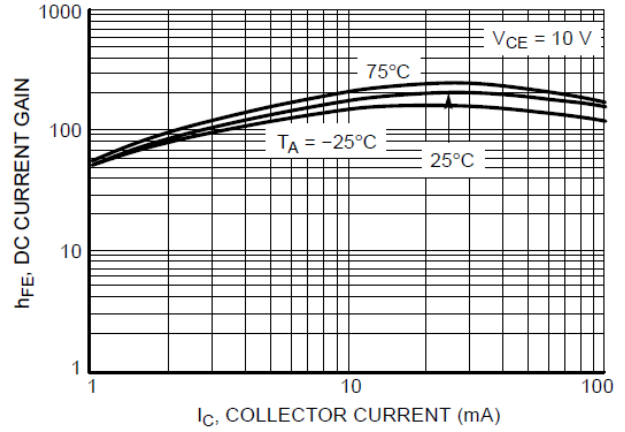


Figure 110. Output Capacitance

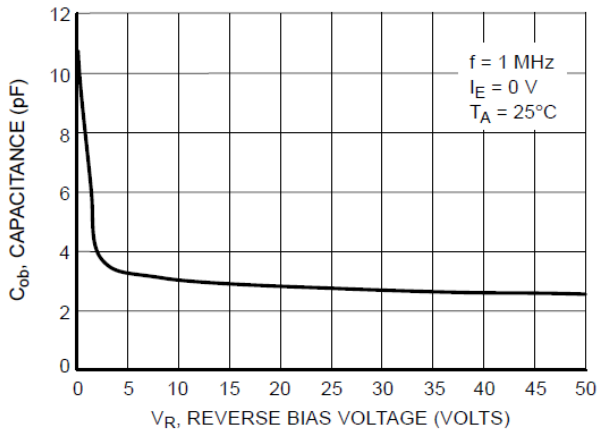


Figure 111. Output Current vs. Input Voltage

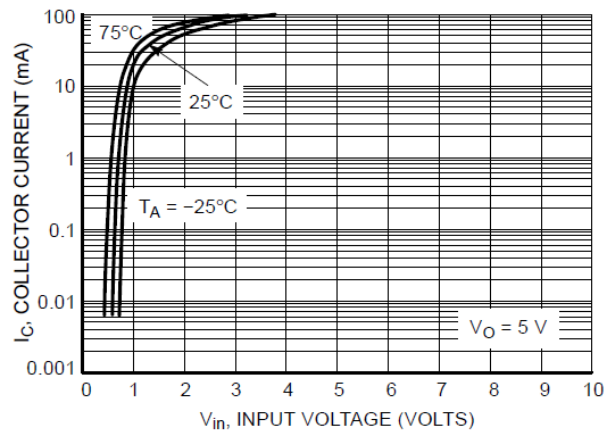
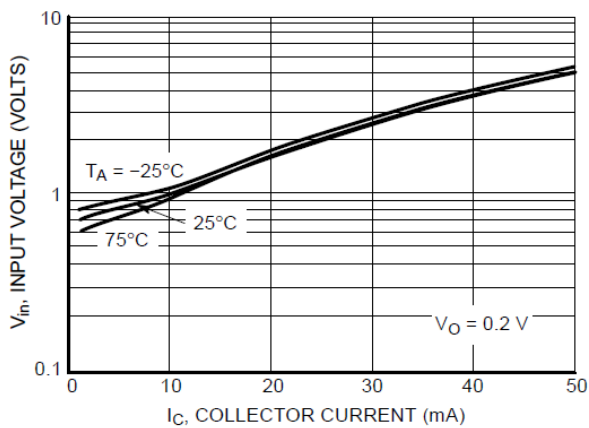


Figure 112. Input Voltage vs. Output Current





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Figure 113. $V_{CE(sat)}$ vs. I_C

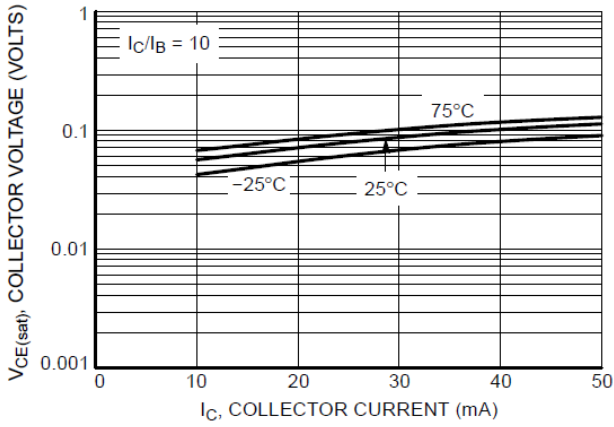


Figure 114. DC Current Gain

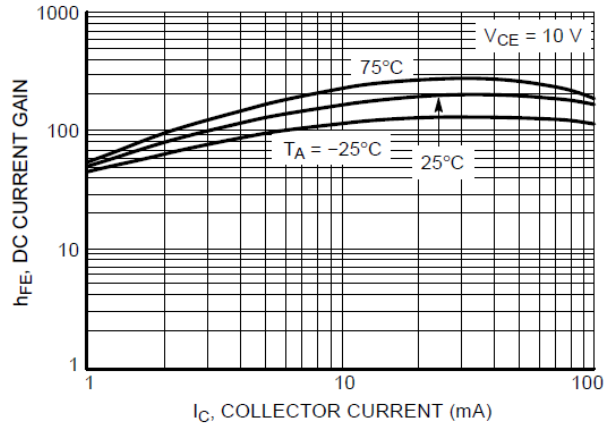


Figure 115. Output Capacitance

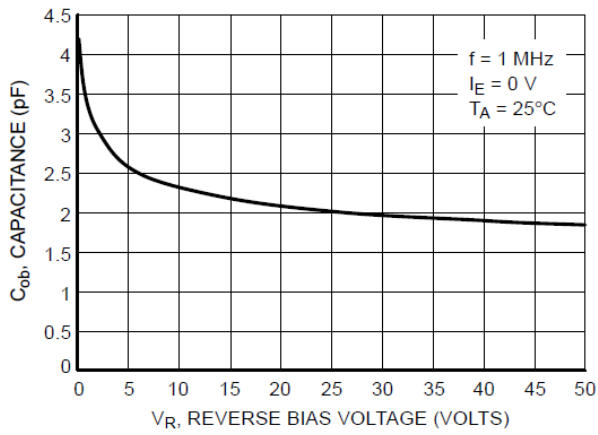


Figure 116. Output Current vs. Input Voltage

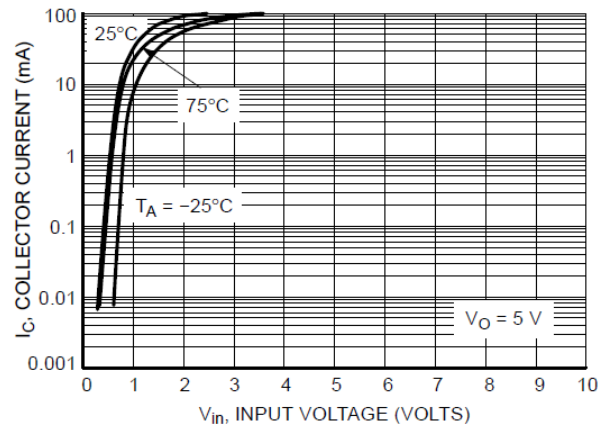
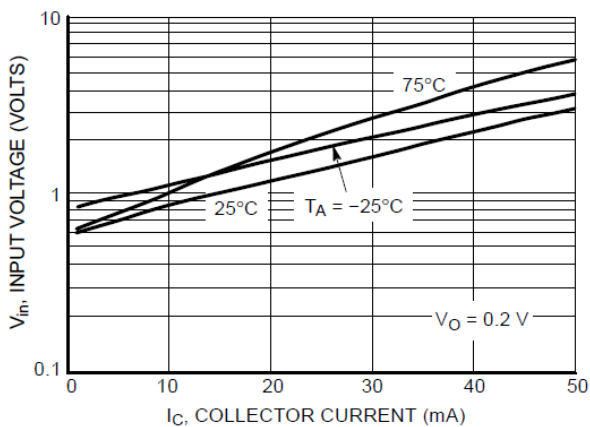


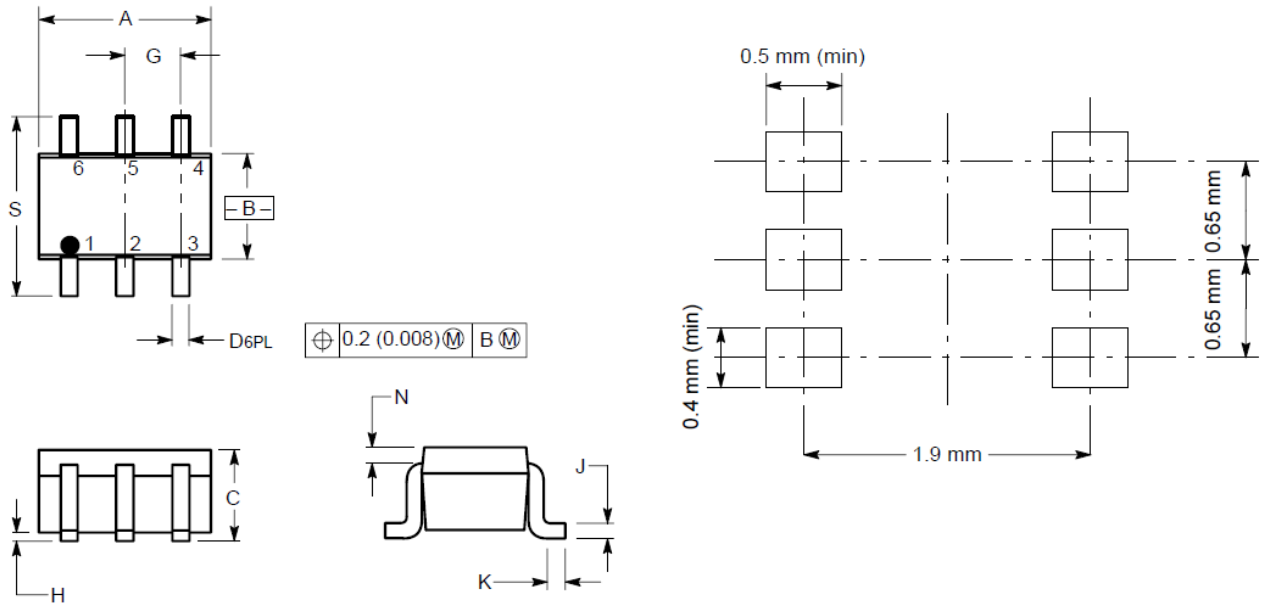
Figure 117. Input Voltage vs. Output Current





PACKAGE INFORMATION

Dimension in SC-88 (Unit: mm)



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	-	0.004	-	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20



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